PION-05909

AM/FM STEREO TUNER

TX-8500II

SERVICE MANUAL

WIDE
NARROW
SIGNAL
TUNING
STEREO
FM
AM
MHz
FUNCTION
OUTPUT LEVEL
MUTING
POWER ON
PIONEER STEREO TUNER TX-8500II

PIONEER

MODEL TX-8500II COMES IN FOUR VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
KC	120V only	CSA (Canada) approved with de-emphasis selector switch (25μs/75μs)
KU	120V only	UL (U.S.A.) approved with de-emphasis selector switch (25μs/75μs)
HG	220V and 240V (Switchable)	SEMKO (Sweden), NEMKO (Norway), DEMKO (Denmark) and EI (Finland) approved
S	110V, 120V, 220V and 240V (Switchable)	General export model with de-emphasis selector switch (25μs/50μs/75μs)

- Service informations for TX-8500II/KU is described on page 5 through 44 in this manual.
- For servicing of KC, S and HG types please refer to TX-8500II/KU manual with the exception of descriptions in the "Additional Service Manual" (p.45—p.82).

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1. SPECIFICATIONS

Semiconductors

FETs	3
ICs	6
Transistors	11
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FM Section

Circuitry	MOS FET 1-stage RF amplifier 4-gang variable capacitor, IF Band Selector, double balanced NFB type PLL MPX built-in pilot signal auto canceller.
Usable Sensitivity	MONO: 10.3dBf (1.8μV)
50dB Quieting Sensitivity	MONO: 16.1dBf (3.5μV) STEREO: 37.2dBf (40μV)
Signal-to-Noise Ratio at 65dBf	MONO: 79dB STEREO: 75dB

		WIDE	NARROW
Distortion at 65dBf	MONO:		
	100Hz	0.1%	0.15%
	1kHz	0.08%	0.15%
	10kHz	0.1%	0.15%
	15kHz	0.15%	—
	STEREO:		
	100Hz	0.15%	0.4%
	1kHz	0.1%	0.4%
	10kHz	0.5%	0.9%
	15kHz	0.8%	—
Capture Ratio		0.8dB	2.0dB
Alternate Channel Selectivity		35dB	80dB
Stereo Separation	1kHz:	45dB	45dB
	50Hz to 15kHz:	35dB	30dB

Frequency Response	20Hz to 10kHz±0.2dB 20Hz to 15kHz$^{+0.2}_{-0.5}$dB
Spurious Response Ratio	90dB
Image Response Ratio	85dB
IF Response Ratio	100dB
AM Suppression Ratio	55dB
Muting Threshold	19.2dBf (5μV)
Subcarrier Product Ratio	72dB
SCA Rejection Ratio	62dB
Antenna Input	300ohms balanced 75ohms unbalanced

AM Section

Circuitry	1 stage RF amplifier 2-gang variable capacitor
Sensitivity	
IHF, ferrite antenna	300μV
IHF, external antenna	15μV
Selectivity	30dB
Signal-to-Noise Ratio	50dB
Image Response Ratio	45dB
IF Response Ratio	50dB
Antenna	Built-in ferrite loopstick antenna

Audio Section

Output (Level/Impedance)	
FM (100% MOD.)	FIXED: 650mV/4.2kΩ VARIABLE: 50mV to 1.3V/3.6kΩ
AM (30% MOD.)	FIXED: 200mV/4.2kΩ VARIABLE: 15mV to 400mV/3.6kΩ

Miscellaneous

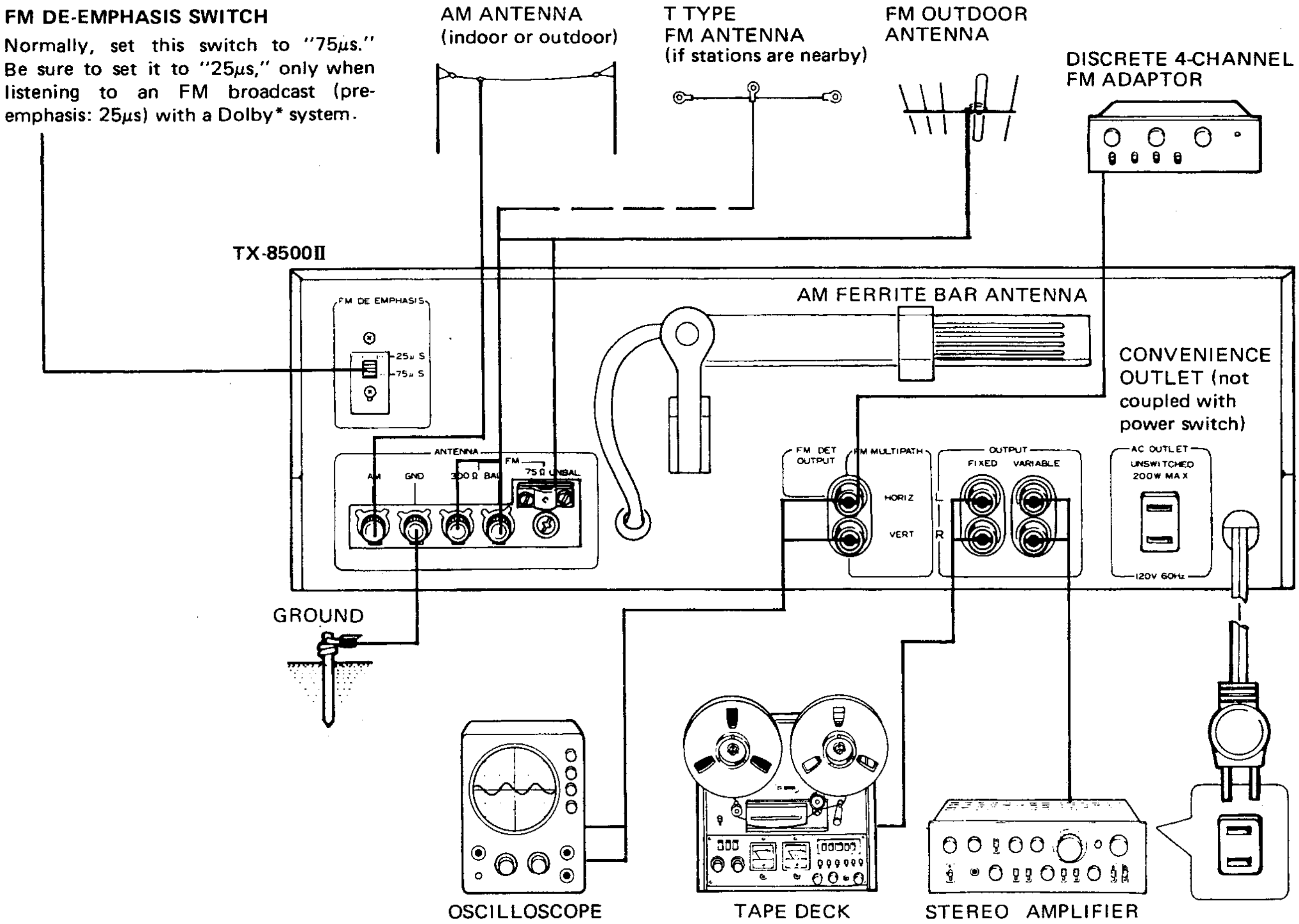
Power Requirements	120V 60Hz only.
Power Consumption	20W
Dimensions	420(W)x150(H)x395(D) mm 16-9/16x5-7/8x15-9/16 in
Weight	Without Package: 8.1kg (17lb 14oz) With Package: 9.6kg (21lb 3oz)

Furnished Parts

FM T-type antenna	1
Operating Instructions	1
Connection Cord with Pin Plugs	1
Hex. Wrench (used for fastening Tuning knob)	1

NOTE:
Specifications and the design subject to possible modification without notice.

2. CONNECTION DIAGRAM



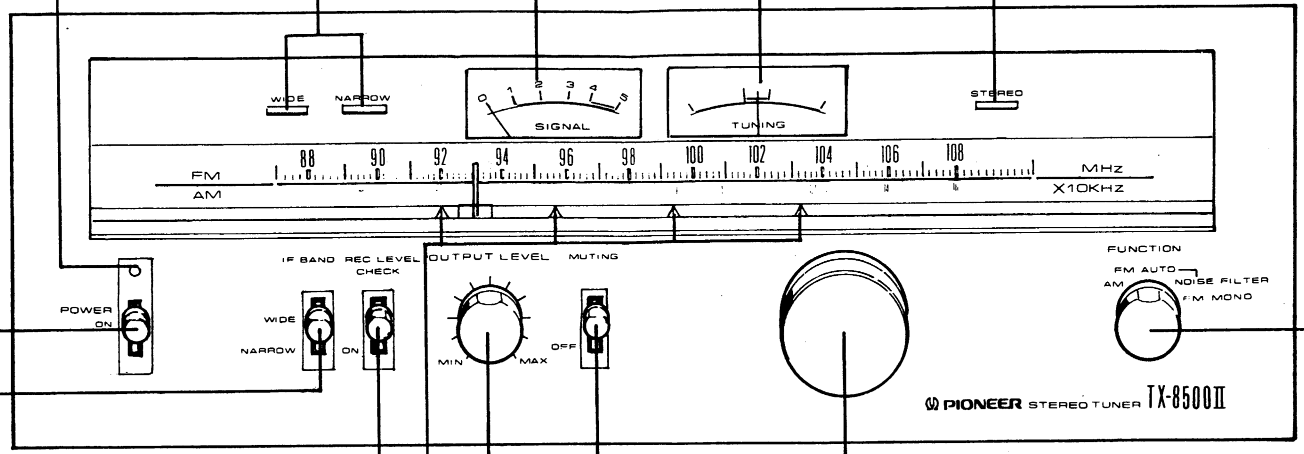
FM DE-EMPHASIS SWITCH

Normally, set this switch to "75μs." Be sure to set it to "25μs," only when listening to an FM broadcast (pre-emphasis: 25μs) with a Dolby* system.

AM ANTENNA
(indoor or outdoor)
T TYPE
FM ANTENNA
(if stations are nearby)
FM OUTDOOR
ANTENNA
DISCRETE 4-CHANNEL
FM ADAPTOR
TX-8500II
FM DE EMPHASIS
25μ S
75μ S
AM FERRITE BAR ANTENNA
CONVENIENCE
OUTLET (not
coupled with
power switch)
ANTENNA
AM
GND
300 Ω BAL
FM
75 Ω UNBAL
FM DET
OUTPUT
FM MULTIPATH
HORIZ
VERT
OUTPUT
FIXED
VARIABLE
L
R
AC OUTLET
UNSWITCHED
200W MAX
120V 60Hz
GROUND
OSCILLOSCOPE
TAPE DECK
STEREO AMPLIFIER

* The word "Dolby" is a trademark of Dolby Laboratories Inc.

3. FRONT PANEL FACILITIES



POWER SWITCH
Set to ON position to turn on power. Pilot lamp will light.

IF BAND SWITCH
FM IF (intermediate frequency) passband can be set to for wide or narrow.
WIDE: Normally set switch to this position.
NARROW: If adjacent station interference is a problem at the WIDE setting, set switch to this position.

REC LEVEL CHECK SWITCH
When set to ON, a 440Hz signal (level corresponding to 50% FM modulation) is produced at approximately 1.7 second intervals. Employ for setting tape deck recording levels. This feature does not operate if the FUNCTION switch is set to AM.

MEMORY MARKERS
Convenient for designating most often tuned in stations. Slide markers with fingertip to desired positions.

OUTPUT LEVEL CONTROL
Adjust level at OUTPUT (VARIABLE) jacks. Clockwise rotation increases output level.

IF BAND INDICATOR

PILOT LAMP

SIGNAL METER
Employ when tuning AM and FM stations. Optimum tuning point occurs when maximum meter deflection toward the right is obtained.

FM MUTING SWITCH
Set to upper (ON) position to eliminate interstation noise on the FM band and provide comfortable station tuning. Since this can also prevent reception of a desired weak signal station, set the switch to OFF in such situations.

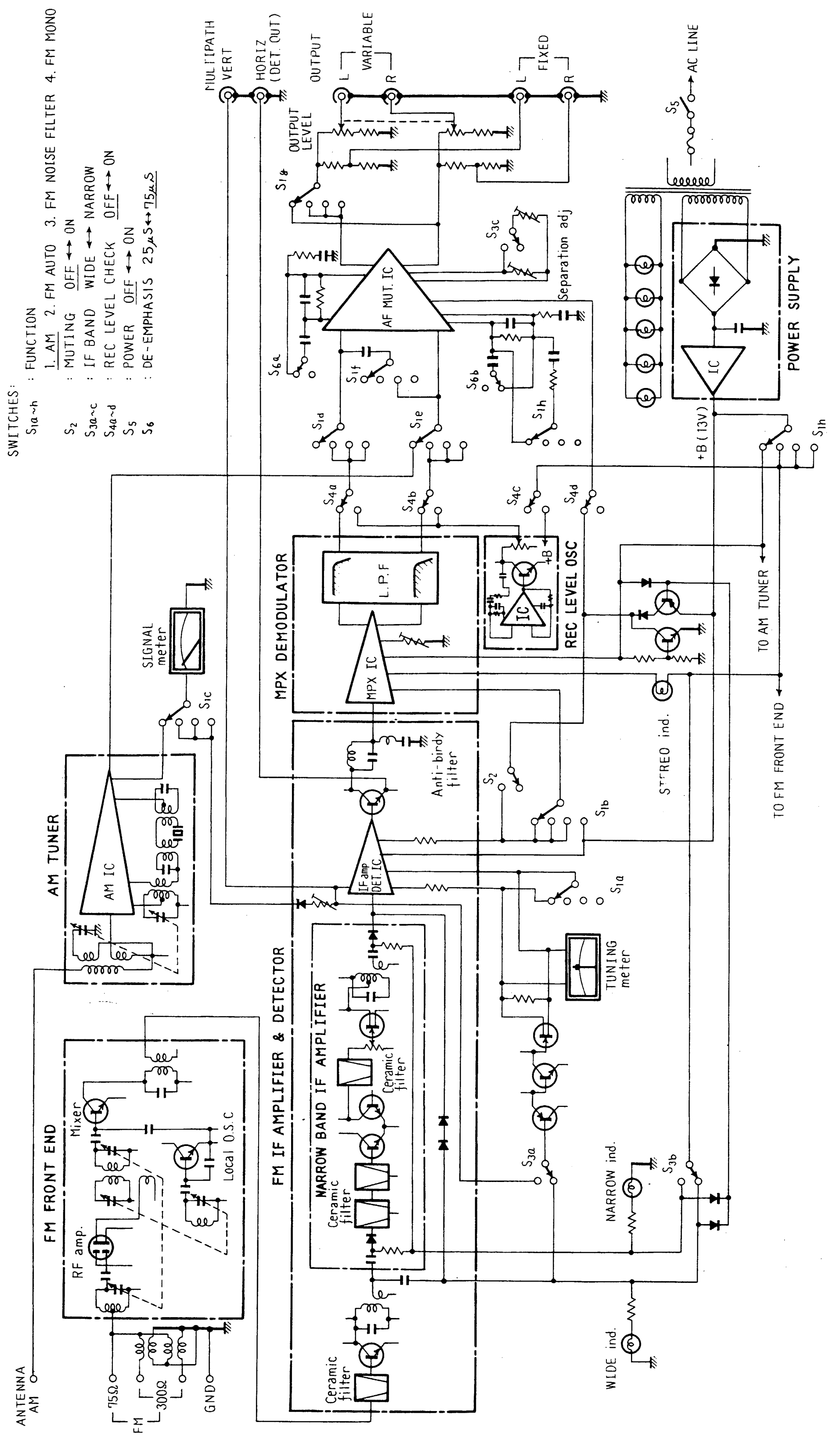
TUNING METER
Use when tuning FM stations. First tune for maximum deflection of the SIGNAL meter (toward the right), then tune carefully so that the meter indicates center of scale (optimum tuning point).

FM STEREO INDICATOR
With the FUNCTION switch set to FM AUTO (or FM NOISE FILTER), the indicator will light during stereo signal reception.

FUNCTION SWITCH
Switch for selecting type of reception.
AM: AM broadcast reception.
FM AUTO: FM stereo reception. If broadcast is FM mono, the mono mode is automatically selected.
FM NOISE FILTER: Set to this position if comparatively high frequency noise becomes objectionable during FM stereo reception. Note that some loss of stereo separation occurs at this position.
FM MONO: FM monophonic reception. Set to this position if reception at FM AUTO position is noisy or signals weak.

TUNING KNOB
Knob for selecting stations. Refer to the SIGNAL meter when tuning AM stations and to both SIGNAL and TUNING meters when tuning FM stations.

4. BLOCK DIAGRAM


SWITCHES:
S1a~h : FUNCTION
1. AM 2. FM AUTO 3. FM NOISE FILTER 4. FM MONO
S2 : MUTING OFF ↔ ON
S3a~c : IF BAND WIDE ↔ NARROW
S4a~d : REC LEVEL CHECK OFF ↔ ON
S5 : POWER OFF ↔ ON
S6 : DE-EMPHASIS 25μS ↔ 75μS
MULTIPATH VERT
HORIZ (DET OUT)
OUTPUT
L VARIABLE R
L FIXED R
AC LINE
OUTPUT LEVEL
AF MUT IC
Separation adj
POWER SUPPLY
+B (13V)
MPX DEMODULATOR
L.P.F
MPX IC
REC LEVEL OSC
TO AM TUNER
TO FM FRONT END
STEREO ind.
Anti-birdy filter
SIGNAL meter
AM TUNER
AM IC
FM IF AMPLIFIER & DETECTOR
NARROW BAND IF AMPLIFIER
IF amp DET IC
Ceramic filter
TUNING meter
NARROW ind.
WIDE ind.
FM FRONT END
Mixer
Local OSC
RF amp.
ANTENNA AM
FM 75Ω 300Ω
GND

5. CIRCUIT DESCRIPTIONS

5.1 FM TUNER

FM Front-End

The major component parts of the front-end are a dual gate MOS FET equipped RF amplifier, a 4-ganged variable capacitor, and a modified Clapp oscillator. Since the transmission characteristics of this FET describe a square relation, there is considerable reduction in the generation of odd harmonics, the main factor which determines the level of spurious response in the linearity of the input/output characteristics. And since input impedance is high, effective connections are possible without decreasing the Q of the tuning circuit, providing a great improvement in selectivity. The dual gate MOS FET also means a higher gain with a higher stability.

In the modified Clapp oscillator, there is very little drift in frequency due to variations in power supply voltage and temperature etc. This type of circuit also improves spurious response since it generates a very clean waveform.

As a result of the incorporation of the above mentioned elements, a usable sensitivity of 1.8μV, an image rejection of 85dB, and a spurious response of 90dB, and other outstanding figures are obtained.

FM IF Amplifier

In this FM IF amplifier, there are two selectable IF frequency pass band widths, viz. a WIDE band and a NARROW band, selected by the IF BAND switch (S_3).

This circuit is shown in Fig. 1.

When the S_3 switch is put in the WIDE position, D_2 and D_3 are biased in the forward direction by +B, and thus turned ON. Consequently, the incoming signal passes from the front-end → ceramic filter (F_1) → Q_1 → T_1 → D_2 and D_3, to FM IF IC (PA3001). That is, the signal passes only one (2-element) ceramic filter (which influences the group delay time flatness characteristics), resulting in a reduction in the generation of phase distortion. This circuit then, has excellent low distortion characteristics.

When S_3 is put in the NARROW position, +B is applied to the NARROW IF AMP. including D_1 and D_4, which are turned ON by the forward direction biasing. So the incoming signal passes from the front-end → ceramic filter (F_1) → Q_1 → T_1 → D_1 → ceramic filters (F_2 and F_3) → Q_2 → Q_3 → ceramic filter (F_4) → VR_1 → Q_4 → T_2 → D_4, and on to FM IF IC (PA3001).

This circuit includes four 2-element ceramic filters, thus the distortion characteristics are not as good as in the WIDE position, but the selectivity is outstanding. So this circuit is particularly suitable for locations where adjacent radio stations are very close together on the FM band.

The FM IF IC (PA3001) is a new IC developed by Pioneer. In comparison to its predecessor, the IC (HA1137), noise in all sections has been reduced, while improvements have been made in the detector circuit (greater efficiency and reduced distortion).

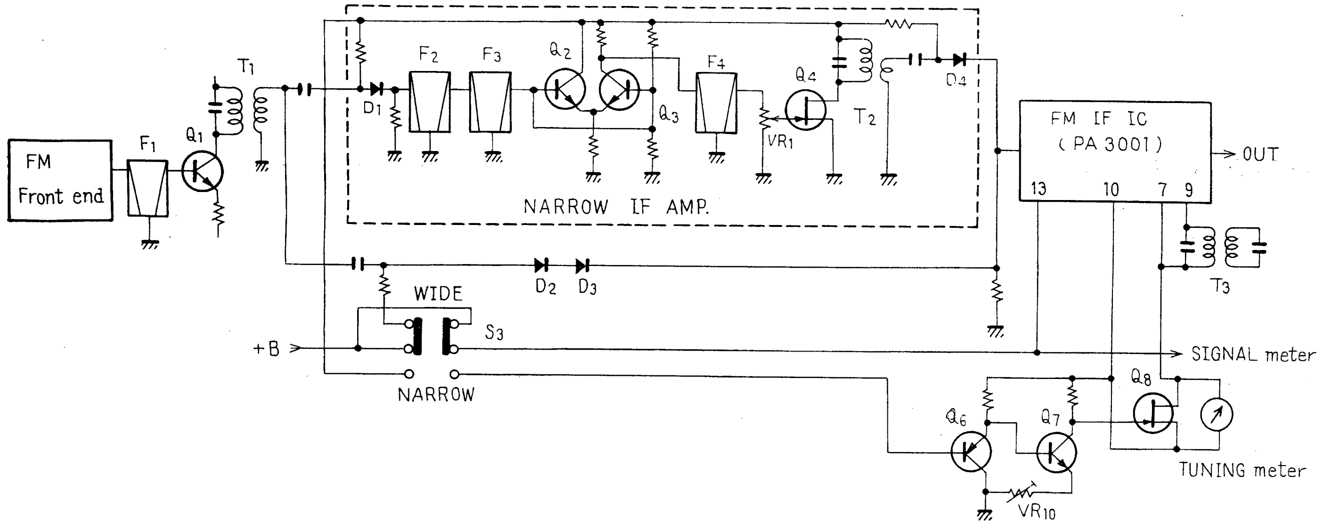

FM Front end
F1
Q1
T1
D1
F2
F3
Q2
Q3
F4
Q4
VR1
T2
D4
NARROW IF AMP.
FM IF IC (PA 3001)
13 10 7 9
OUT
T3
WIDE
D2 D3
+B
S3
NARROW
SIGNAL meter
Q6
Q7
Q8
TUNING meter
VR10

Fig. 1 FM IF Amplifier circuit

Furthermore, differences in the center position of the TUNING meter between WIDE band and NARROW band (due to change in band width), have been eliminated by the use of the $Q_6 - Q_8$ circuitry.

The TUNING meter needle is adjusted to the center position when no station is tuned with the WIDE band, by means of T_3. When operating in the NARROW band, the base of Q_6 is connected to terminal no. 13 of PA3001. This terminal is designed for the SIGNAL meter, and is set to 0V when no station is tuned. Since it's base voltage is 0V, Q_6 will be ON, Q_7 will turn OFF, and Q_8 turn ON. With Q_8 ON, the voltage between the terminals of the TUNING meter is also 0V, thus keeping the meter needle in the central position. When a station is tuned in, the voltage in the SIGNAL meter circuit (terminal no.13 of PA3001) increases, turning Q_6OFF, Q_7 ON, and Q_8 OFF. When Q_8 is turned OFF, the TUNING meter needle will deflect in the same manner as in the WIDE band position.

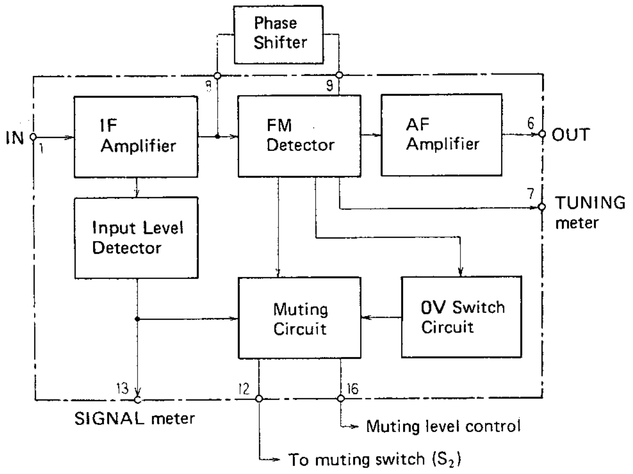

Phase Shifter
IN
1
IF Amplifier
8
9
FM Detector
AF Amplifier
6
OUT
7
TUNING meter
Input Level Detector
Muting Circuit
0V Switch Circuit
13
12
16
SIGNAL meter
Muting level control
To muting switch (S2)

Fig. 2 Block diagram of PA3001

FM Multiplex Decoder

This section includes another IC recently developed by Pioneer, the PA1001. See Fig. 3 for the block diagram.

This IC, an improvement over a previous IC (HA1196), incorporates a pilot auto-canceller circuit. This circuit filters out the leak carrier (19kHz) contained in the demodulated signal without any loss in the frequency characteristics of the audio signal. This filtering action is a considerable improvement over the previous low pass filter method. Other features include a wider input dynamic range, and the ability to perform well even when a 300% modulated input signal is applied to the IC. S/N ratio and distortion factor have also been improved by the incorporation of an NFB circuit in the decoder amplifier. Distortion has also been improved in the case of MONO signals by connecting together the output circuits of the L and R channels. Thus the out-of-phase distortion components contained in the L and R channel audio signals will be cancelled.

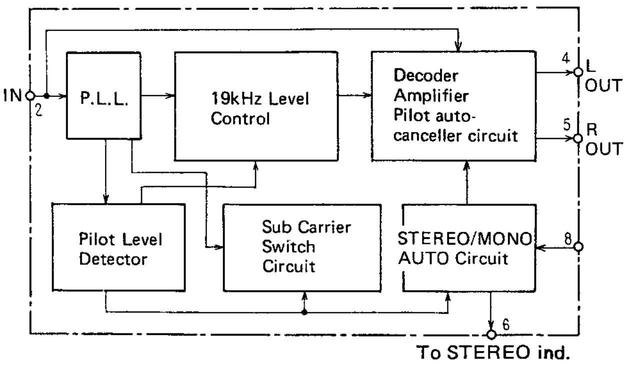

IN
2
P.L.L.
19kHz Level Control
Decoder Amplifier Pilot auto-canceller circuit
4
L OUT
5
R OUT
Pilot Level Detector
Sub Carrier Switch Circuit
STEREO/MONO AUTO Circuit
8
6
To STEREO ind.

Fig. 3 Block diagram of PA1001

AF Amplifier and Muting

This circuit employs the Pioneer developed IC (PA1002). The block diagram is shown in Fig. 4.

This AF amplifier is a direct coupled amplifier used as a differential NFB amplifier providing outstanding dynamic range, S/N ratio, and distortion factor. De-emphasis has been provided by inserting a time constant circuit in the NFB loop of the AF amplifier. The elements in this time constant circuit include a metal film resistor (1% tolerance) and a polystyrene film capacitor (2% tolerance)

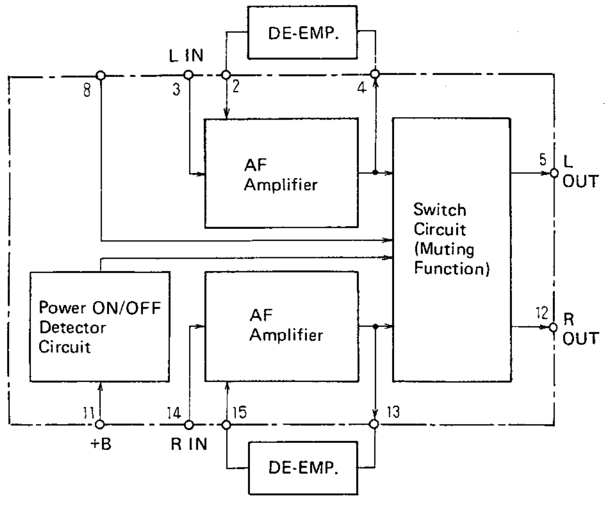

DE-EMP.
L IN
8
3
2
4
AF Amplifier
Switch Circuit (Muting Function)
5
L OUT
Power ON/OFF Detector Circuit
AF Amplifier
12
R OUT
11
14
15
13
+B
R IN
DE-EMP.

Fig. 4 Block diagram of PA1002

which have made it possible to reduce de-emphasis deviation to within +0.2dB to −0.5dB in the 20Hz to 15kHz range.

The switching circuit for the muting function is activated when a DC voltage from the power ON/OFF detector section, or from terminal no.8 is received. The signal circuit is then connected to ground, thus preventing the output of any signals.

This power ON/OFF detector circuit detects the instantaneous change when the POWER switch is turned ON or OFF, sending a trigger signal to the switching circuit, and thus usually activating the muting function. As a result, the popping noise generated when the POWER switch is turned ON or OFF, plus the residual noise, is eliminated.

Muting Circuit

See Fig. 5 for the Muting Control Circuit.

Terminal no.12 of PA3001 is designed to generate a DC voltage of 1.3 to 5V when the tuning frequency is at least approx. 70kHz distant from the nearest radio station, or when the antenna input drops below 14dB (5μV).

When the MUTING switch is turned ON, terminal no.8 of PA1002 is connected to terminal no.12 of PA3001. The DC voltage from terminal no.12 activates a switch circuit in PA1002 to operate the muting function.

Muting is also brought into operation when the FUNCTION switch is turned from AM to FM, or when the IF BAND switch is changed over between NARROW and WIDE.

That is, the moment the FUNCTION switch is turned from AM to FM, the +B switching section of the FUNCTION switch is opened and +B_1 and +B_2 will both drop momentarily to 0V. Q_{13} will turn ON the instant its base voltage becomes 0V, allowing +B_3 to pass through and charge C_{89}. Q_{13} is turned OFF again almost immediately, but the electrical charge on C_{89} passes through D_8, and is applied to terminal no.8 of PA1002, activating the switch circuit, and the system passes into muting status. This muting status is released when the charge on C_{89} finally discharges via R_{68}.

When the IF BAND switch setting is changed, the Q_{13} base voltage is designed to drop to 0V instantaneously by means of an open contact in the +B switching section of the IF BAND switch. Q_{13} will thus be turned ON as before, with all subsequent steps being the same as when the FUNCTION switch was operated.

When the FUNCTION switch is in the AM position, or when the REC LEVEL CHECK is ON, the muting circuit is not activated. That is, in the AM position, +B_1 is applied to the bases of Q_{13} and Q_{11}, turning Q_{13} OFF and Q_{11} ON. Hence, terminal no.8 of PA1002 is connected to ground.

When the REC LEVEL CHECK is ON, the circuitry connected to terminal no.8 of PA1002 is disconnected, thus preventing the muting circuit from operating.

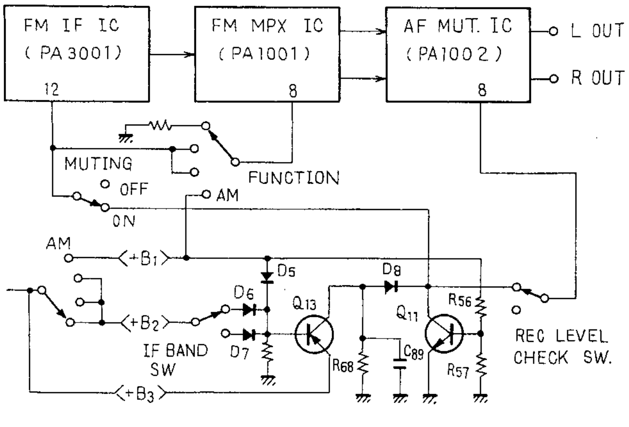


Fig. 5 Muting control circuit

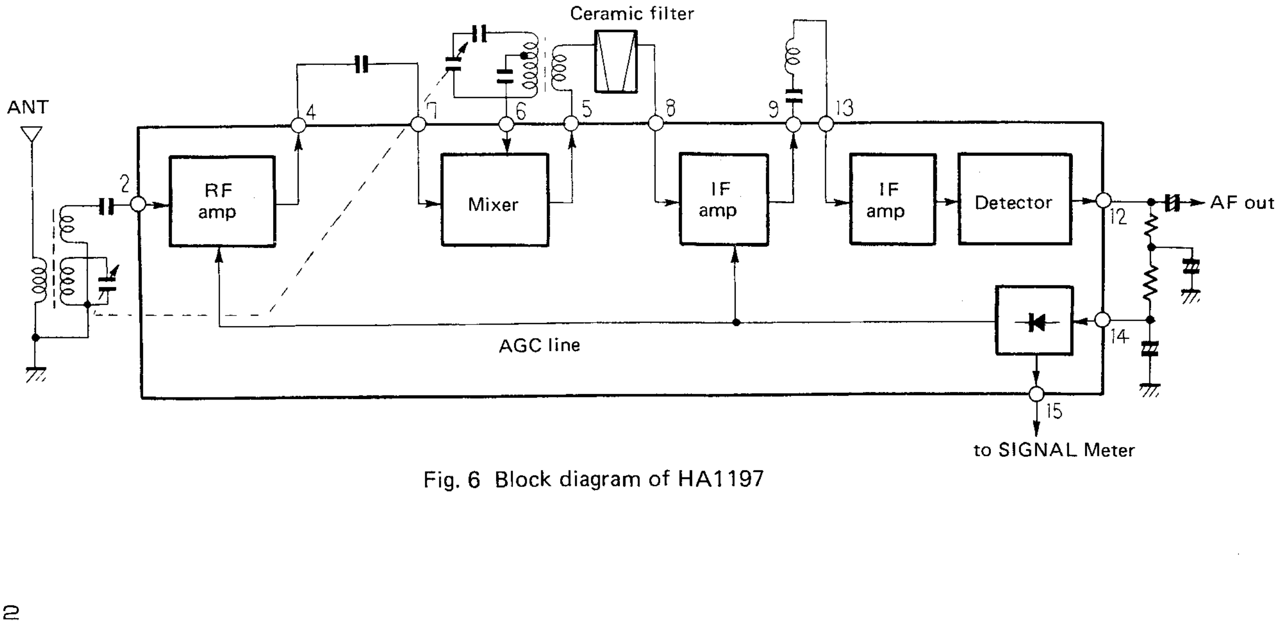


Fig. 6 Block diagram of HA1197

5.2 AM TUNER

The major components of the AM tuner are the 2-ganged variable capacitor, a newly developed IC (HA1197), and an AM ceramic filter. A block diagram of the HA1197 is shown in Fig. 6.

This IC consists of an RF amplifier in the first stage, followed by a mixer stage which also includes a self-oscillating local oscillator, the IF amplifier 3rd and 4th stages, and a detector circuit final stage. The AGC (Automatic Gain Control) receives an AGC voltage from the output of the detector circuit, and applies it to the RF amplifier and IF amplifier stages. The advantage of the HA1197 is a large reduction in distortion at low frequencies. Whereas the distortion at 100Hz was 1.5% in the previous HA1138, this figure has been reduced to 0.4% (100Hz) in the HA1197.

5.3 REC LEVEL CHECK SIGNAL GENERATOR CIRCUIT

This circuit, consisting of one transistor and an IC (HA1452W), produces tone bursts every 3.4 sec. for 1.7 sec. intervals by means of a 440Hz signal. The output level corresponds to a value equivalent to an FM broadcast with 50% modulation. The circuit is outlined in Fig. 7.

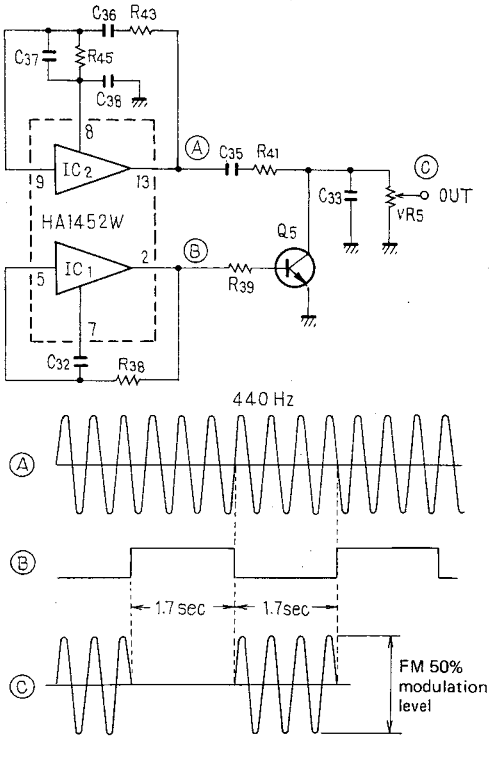


Fig. 7

The IC HA1452W incorporates two pairs of operational amplifiers, one being used as a 440Hz sine wave oscillator, and the other as a square wave oscillator, which cycles on or off every 3.4 sec. for 1.7 sec. The switching action of Q_5 converts this square wave into tone bursts. When the square wave is applied to the base of Q_5, Q_5 is turned ON and OFF, thus converting into a 440Hz tone bursts by shorting the sine wave oscillator to ground when Q_5 is turned ON.

5.4 POWER SUPPLY CIRCUIT

This circuit, too, employs one of Pioneer's recently developed IC (PA2002), resulting in better S/N ratio, stability, and a greater degree of reliability.

PA2002 is an IC used to provide constant voltages, and it incorporates a protection circuit. A block diagram is outlined in Fig. 8.

The protection circuit is composed of control circuits activated by overcurrents, and control circuits activated by overvoltages. The protection circuit is activated when either a current in excess of 760mA (resulting from an overload) flows through the IC output (terminal no.10), or a voltage in excess of 27V is applied to the IC input (terminal no.1). Once this protector circuit is activated, no output voltage will appear at terminal no.10.

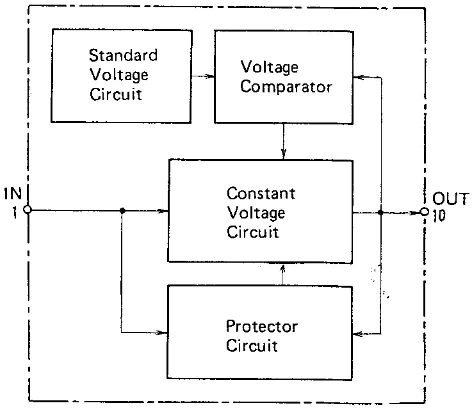


Fig. 8 Block diagram of PA2002

6. DISASSEMBLY

1. Remove the 4 screws (A) securing both sides of the bonnet case.
2. Remove the 9 screws (B) securing the bottom plate.
3. Remove all the knobs from the front panel. In the case of the TUNING knob, a securing screw must first be loosened. Now remove the 3 nuts (C) and the 2 screws (D) securing the top of the front panel, which may now be taken off.

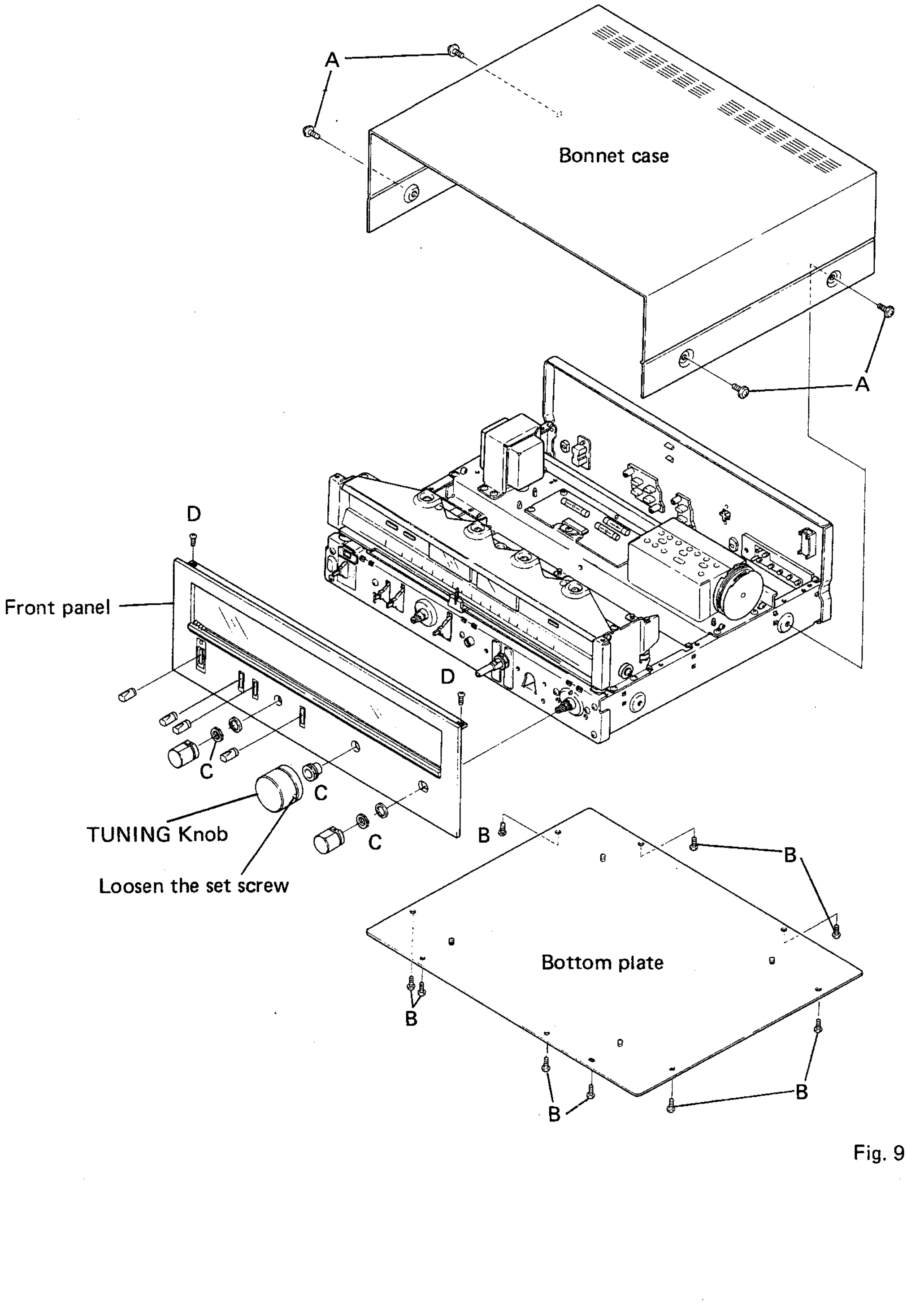
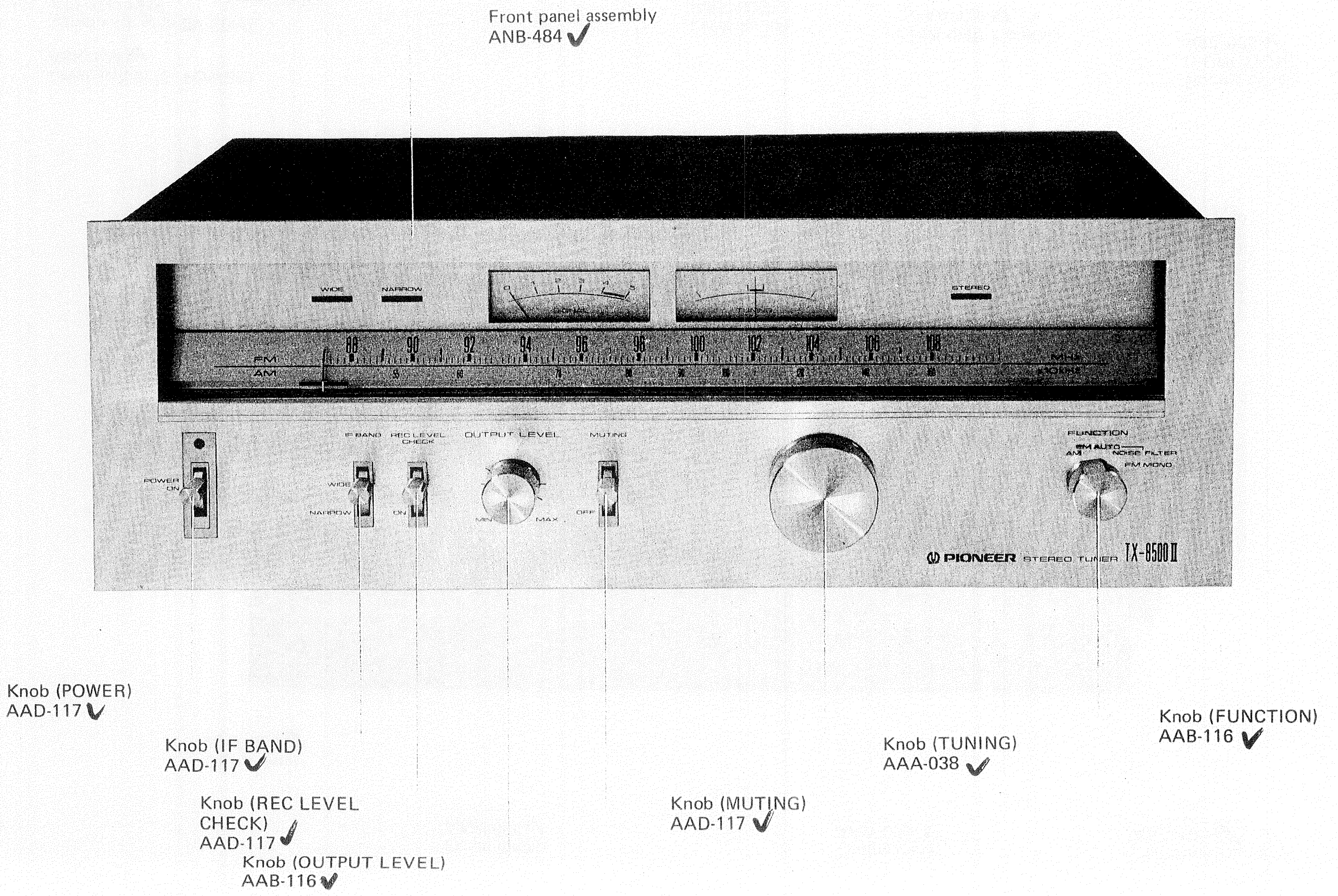

A
Bonnet case
A
D
Front panel
D
C
C
TUNING Knob
C
Loosen the set screw
B
B
B
Bottom plate
B
B

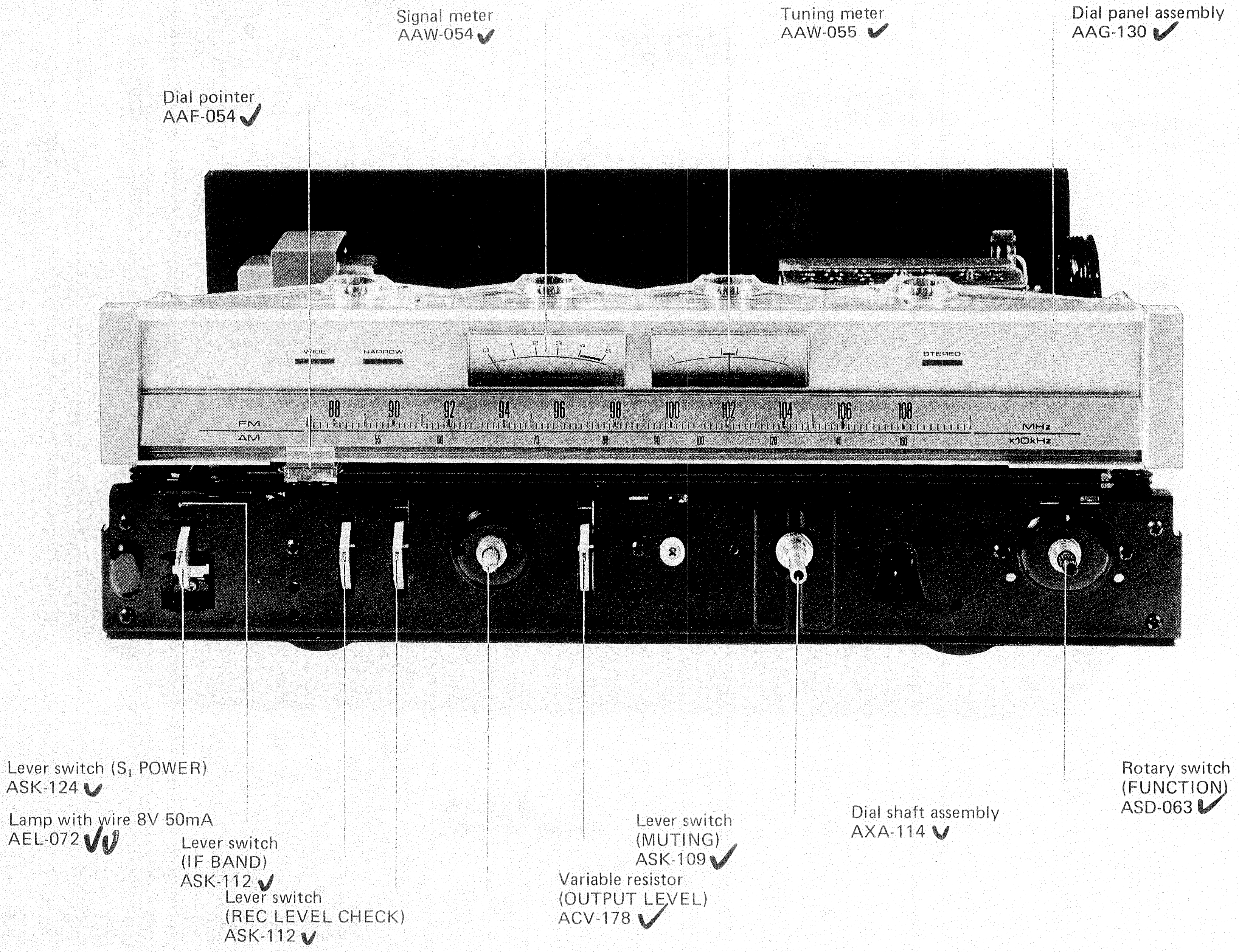
Fig. 9

7. PARTS LOCATION

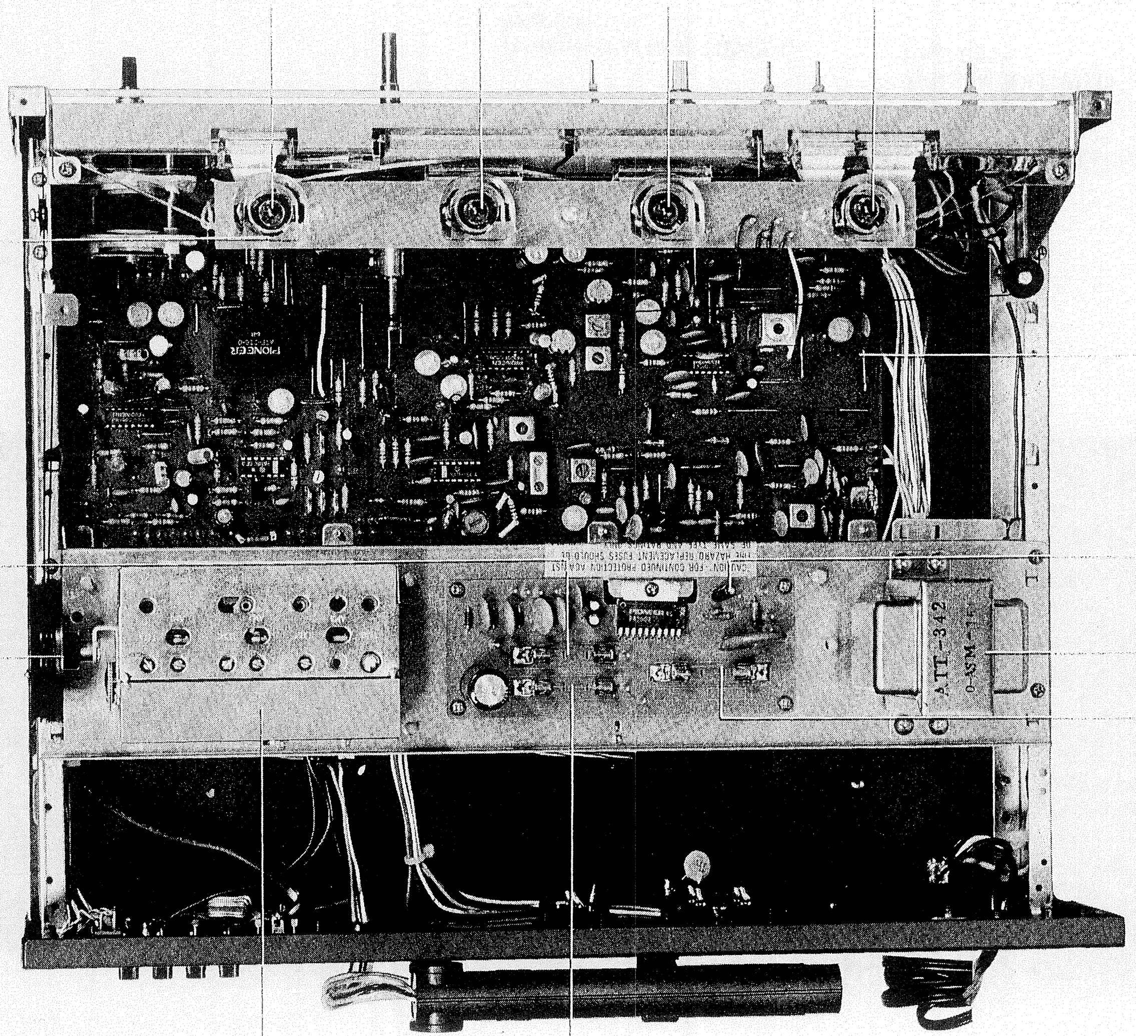
7.1 FRONT PANEL VIEW


Front panel assembly
ANB-484 ✓
Knob (POWER)
AAD-117 ✓
Knob (IF BAND)
AAD-117 ✓
Knob (REC LEVEL CHECK)
AAD-117 ✓
Knob (OUTPUT LEVEL)
AAB-116 ✓
Knob (MUTING)
AAD-117 ✓
Knob (TUNING)
AAA-038 ✓
Knob (FUNCTION)
AAB-116 ✓
WIDE
NARROW
STEREO
FM
AM
88
90
92
94
96
98
100
102
104
106
108
MHz
kHz
POWER
ON
IF BAND
WIDE
NARROW
REC LEVEL CHECK
ON
OUTPUT LEVEL
MIN
MAX
MUTING
OFF
FUNCTION
FM AUTO
AM
NOISE FILTER
FM MONO
PIONEER STEREO TUNER TX-8500II

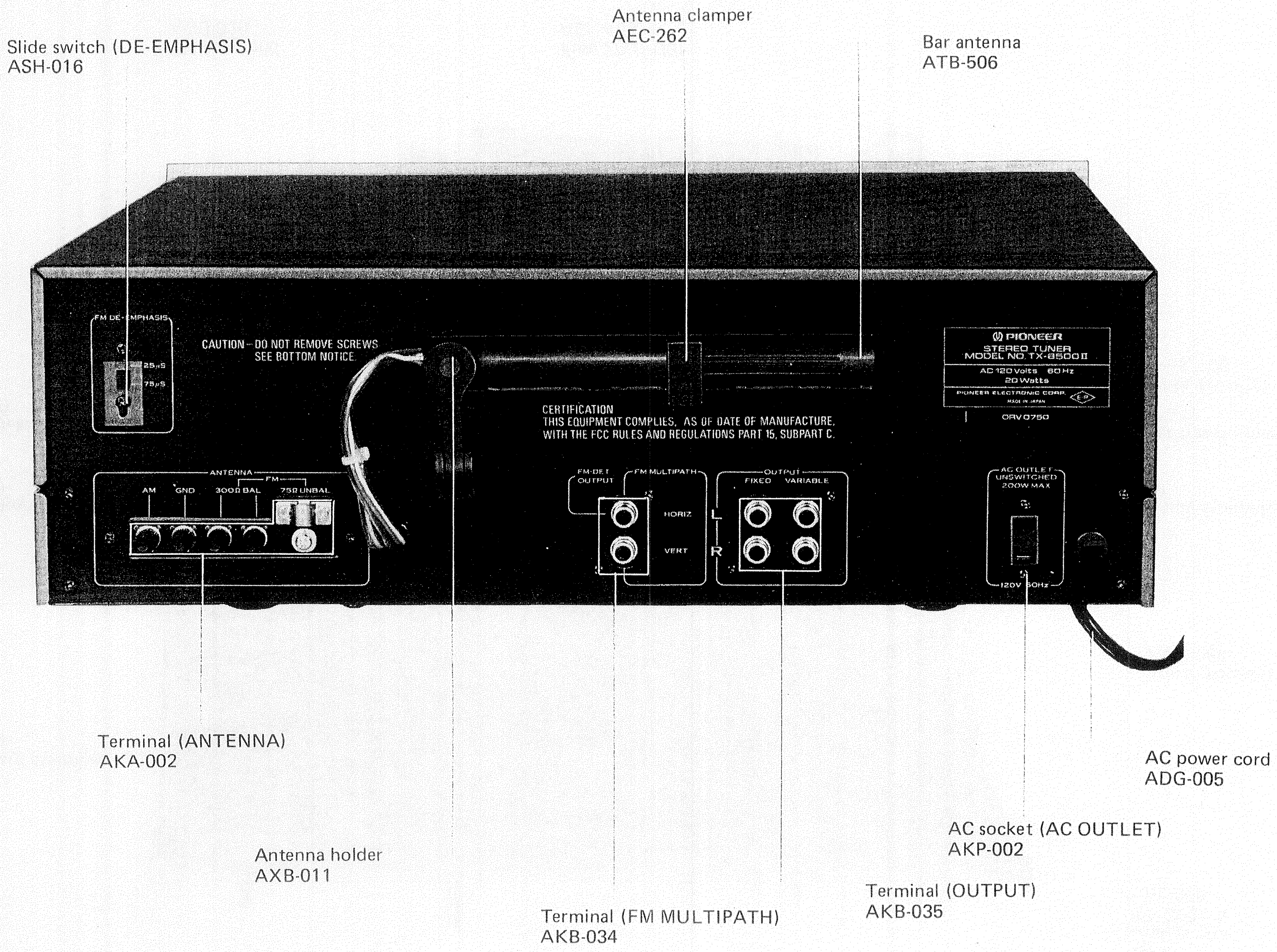
7.2 FRONT VIEW WITH PANEL REMOVED


Signal meter
AAW-054 ✓
Tuning meter
AAW-055 ✓
Dial panel assembly
AAG-130 ✓
Dial pointer
AAF-054 ✓
WIDE
NARROW
STEREO
88 90 92 94 96 98 100 102 104 106 108
FM
AM
55 60 70 80 90 100 120 140 160
MHz
x10kHz
Lever switch (S_1 POWER)
ASK-124 ✓
Lamp with wire 8V 50mA
AEL-072 ✓✓
Lever switch
(IF BAND)
ASK-112 ✓
Lever switch
(REC LEVEL CHECK)
ASK-112 ✓
Lever switch
(MUTING)
ASK-109 ✓
Variable resistor
(OUTPUT LEVEL)
ACV-178 ✓
Dial shaft assembly
AXA-114 ✓
Rotary switch
(FUNCTION)
ASD-063 ✓

7.3 TOP VIEW


Lamp
(Wedge type)
8V, 300mA
AEL-029
Lamp board assembly
AWX-104
Tuner assembly
AWE-084
Fuse 500mA (FU2)
AEK-107
Power supply assembly
AWR-119
Dial dram assembly
AXA-070
Power transformer
ATT-342
Fuse 1A (FU1)
AEK-106
FM front end
AWB-028
Fuse 2A (FU3)
AEK-103

7.4 REAR PANEL VIEW


Slide switch (DE-EMPHASIS)
ASH-016
Antenna clamper
AEC-262
Bar antenna
ATB-506
FM DE-EMPHASIS
25μS
75μS
CAUTION—DO NOT REMOVE SCREWS
SEE BOTTOM NOTICE.
PIONEER
STEREO TUNER
MODEL NO. TX-8500II
AC 120 Volts 60 Hz
20 Watts
PIONEER ELECTRONIC CORP.
MADE IN JAPAN
ORV0750
CERTIFICATION
THIS EQUIPMENT COMPLIES, AS OF DATE OF MANUFACTURE,
WITH THE FCC RULES AND REGULATIONS PART 15, SUBPART C.
ANTENNA
FM
AM
GND
300Ω BAL
75Ω UNBAL
FM-DET
OUTPUT
FM MULTIPATH
HORIZ
VERT
L
R
OUTPUT
FIXED
VARIABLE
AC OUTLET
UNSWITCHED
200W MAX
120V 60Hz
Terminal (ANTENNA)
AKA-002
Antenna holder
AXB-011
Terminal (FM MULTIPATH)
AKB-034
Terminal (OUTPUT)
AKB-035
AC socket (AC OUTLET)
AKP-002
AC power cord
ADG-005

8. DIAL CORD STRINGING

1. Remove the top cover and the front panel (p.14).
2. Rotate the front-end variable capacitor shaft right around in the maximum clockwise direction.
3. Tie one end of the cord around the protruding pin on the inside of the dial drum assembly.
4. Fix the dial drum assembly to the variable capacitor shaft so that the set screw is pointing upwards.
5. Pass the cord tied to the dial drum assembly, through the cut out part of the assembly.
6. Now pass the cord over pulley A, wind 3 times around the dial tuning shaft, and continue over pulleys B, C, D, and E.
7. From pulley E, wind the cord twice around the dial drum assembly along the grooves, and then tie to the spring.
8. Rotate the dial tuning shaft to check for any abnormal behavior in the movement of the cord and the dial drum assembly. If everything is in order, cut off the remaining cord.
9. Rotate the dial tuning shaft around in the counterclockwise direction until it stops. Adjust the dial indicator to the starting point at the left hand side of the dial scale, and then secure the cord reasonably firm.

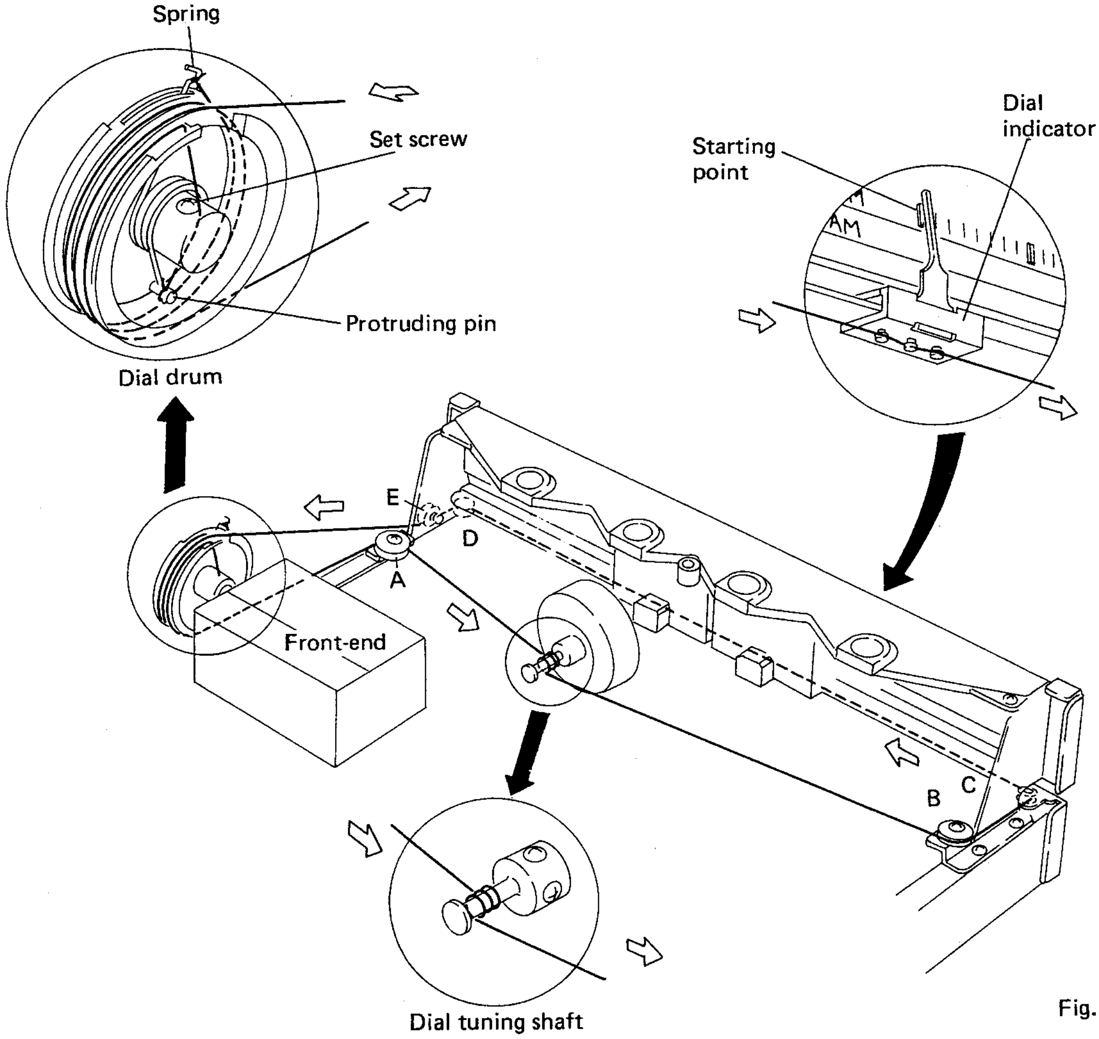


Fig. 10

9. ADJUSTMENTS

9.1 FM SECTION

FM Front-end

When the TUNING knob is turned completely in the counterclockwise direction, the dial indicator should be aligned with the starting point on the far left of the dial scale.

1. Turn the MUTING, and REC LEVEL CHECK switches on the front panel to the OFF positions, turn the IF BAND switch to the NARROW position, and the FUNCTION switch to the FM MONO position.
2. Connect up the test instruments as shown in Fig. 11, and adjust FM Signal Generator (FM SG) to 90MHz, modulation frequency of 400Hz, 100% modulation, and output of 10dB.
3. Set the dial indicator of the TX-8500II to 90MHz, and adjust each of the cores of L_O, L_A, L_{R1}, and L_{R2} in the front-end for maximum deflection in the AC voltmeter.
4. Now set the dial indicator of TX-8500II and FM SG to 106MHz, and adjust each of the trimmers of TC_O, TC_A, TC_{R1}, and TC_{R2} in the FM front-end to give maximum deflection on the AC voltmeter.
5. Repeat steps 2 to 4 so that the AC voltmeter deflections are more or less the same at both 90MHz and 106MHz.
6. Once these adjustments have been completed, check for the occurence of oscillations etc.

FM Muting Circuit

1. Connect the test instruments as shown in Fig. 12.
2. Turn the MUTING and REC LEVEL CHECK switches on the front panel OFF, turn the IF BAND switch to the NARROW position, and the FUNCTION switch to FM AUTO.
3. Turn VR_{10} of the tuner assembly completely in the clockwise direction, and VR_1 in the maximum counterclockwise direction.
4. Adjust the FM Signal Generator (FM SG) to 100% modulation, 40dB output, and 400Hz modulation frequency.
5. Set the FM SG and TX-8500II dial indicator to 98MHz, and then adjust the core of T_2 in the tuner assembly, and the IF TRANS in the FM front-end to give maximum deflection on the SIGNAL meter.

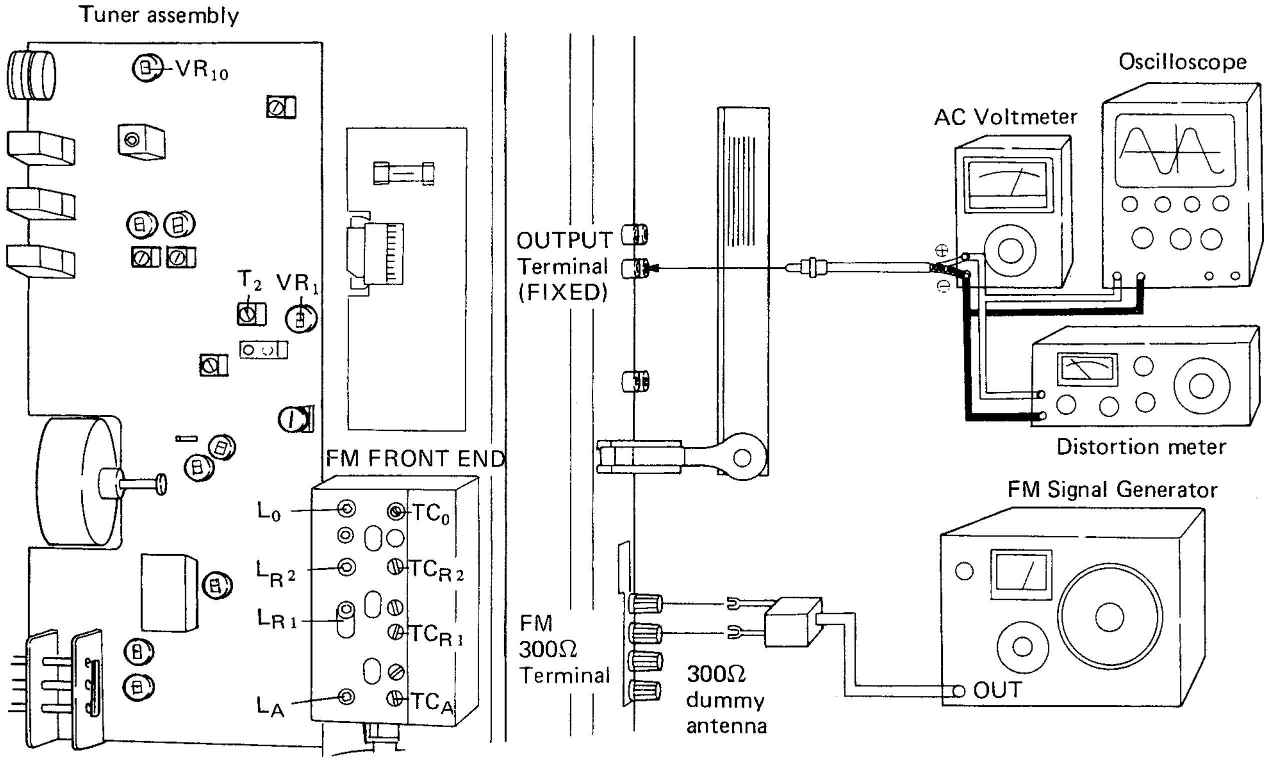

Tuner assembly
VR10
T2
VR1
FM FRONT END
L0
TC0
LR2
TCR2
LR1
TCR1
LA
TCA
OUTPUT Terminal (FIXED)
FM 300Ω Terminal
300Ω dummy antenna
Oscilloscope
AC Voltmeter
Distortion meter
FM Signal Generator
OUT

Fig. 11

6. Change the IF BAND switch to the WIDE position.
7. Set the dial indicator to a station-free position near 98MHz, and then adjust the primary coil (lower side) of T_3 so that the TUNING meter needle is right at the center of the marker.
8. Retune TX-8500II to 98MHz, but change the FM SG output to 60dB. Now adjust the secondary coil (upper side) of T_3 to reduce distortion to a minimum.
9. Recheck that the TUNING meter needle indicates dead center when no station is tuned. If it is not exactly in the center as before, readjust by repeating steps 7 and 8 above.
10. Change the FM SG output to 100dB. Adjust VR_2 so that the SIGNAL meter needle reads 4.8 on the scale. Set the FM SG to 30% modulation. And then readjust the FM SG output so that the needle now reads 2.5.
11. Change the FM BAND switch to the NARROW position, and adjust VR_1 so that the SIGNAL meter needle again reads 2.5.
12. Change the IF BAND switch back to the WIDE position, and turn the MUTING switch ON.
13. Set the FM SG to 100% modulation, 20dB output, and adjust VR_9 to a position just below that necessary to activate the muting function.
14. Change the IF BAND back to the NARROW position and check that the muting is activated as a result of the change over at 22dB ±3dB.
15. Turn the MUTING switch OFF, and set the IF BAND switch to the NARROW position. Adjust the FM SG output to 15dB.
16. Tune the TUNING knob a bit so that TUNING meter needle is near the marker end (Fig. 13). Adjust VR_{10} so that the needle indicates dead center of the marker.
17. Now turn the FM SG output down, and change the IF BAND switch when there is only noise present. The TUNING meter needle discrepancy should be less than 1/2 of the needle's width.

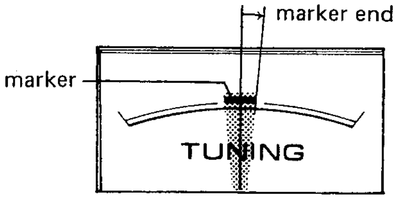

marker end
marker
TUNING

Fig. 13 TUNING meter

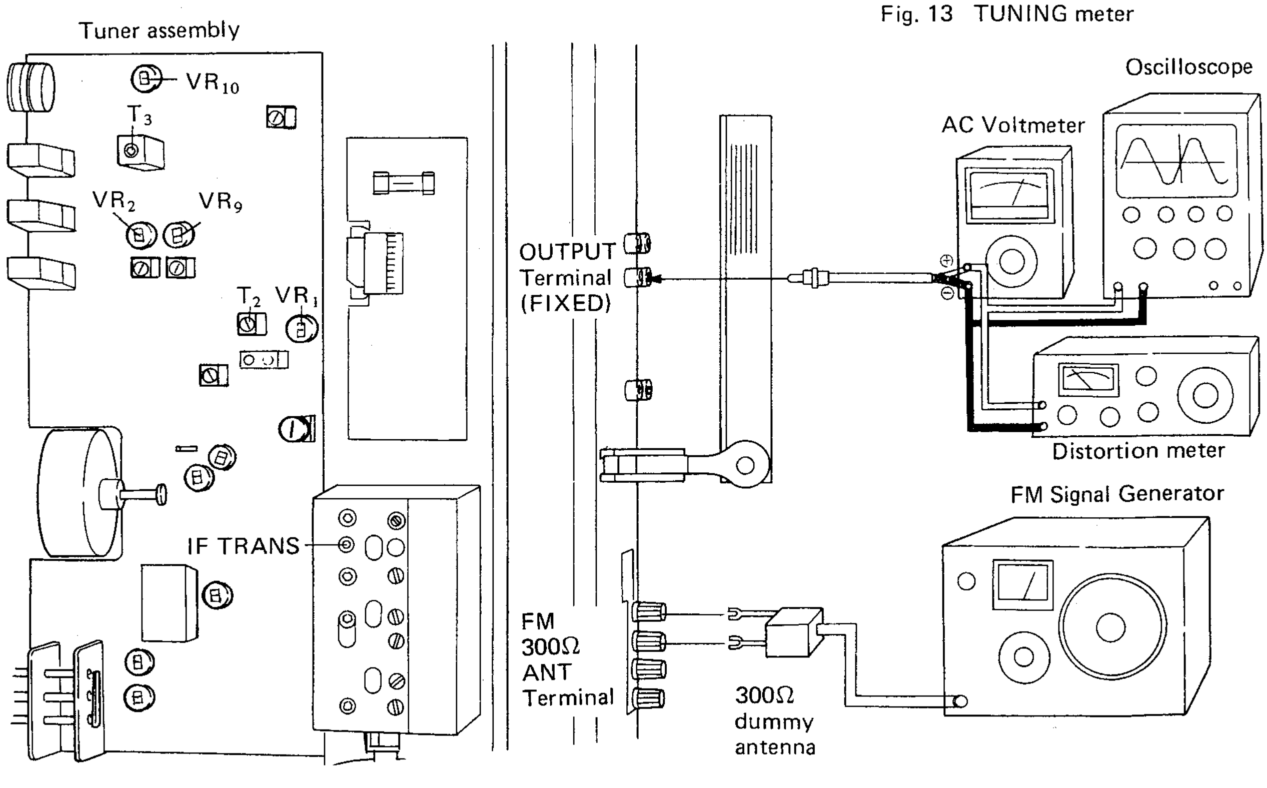

Tuner assembly
VR10
T3
VR2
VR9
T2
VR1
IF TRANS
OUTPUT
Terminal
(FIXED)
FM
300Ω
ANT
Terminal
300Ω
dummy
antenna
Oscilloscope
AC Voltmeter
Distortion meter
FM Signal Generator

Fig. 12

FM MPX Circuit

1. Connect up the test instruments as shown in Fig. 14.
2. Turn the MUTING and REC LEVEL CHECK switches on the front panel OFF, set the IF BAND switch to the WIDE position, and turn the FUNCTION switch to FM AUTO.
3. Adjust FM SG for zero modulation, and 60dB output.
4. Tune the dial indicator of TX-8500II and FM SG to 98MHz.
5. Connect the PILOT OUT terminal of MPX Signal Generator (MPX SG) to the HORIZONTAL input terminal of an oscilloscope, and terminal no.34 of the tuner assembly to the VERTICAL input terminal (but via a 10:1 probe).
6. Adjust VR_4 to bring the Lissajous waveform shown in the oscilloscope to a halt.
7. With the FM SG acting as an external modulator, apply the MPX SG pilot signal (19kHz), with 7.5kHz deviation, to the input terminal of the FM SG external modulator.
8. Adjust VR_3 in order to reduce the amount of pilot signal leakage appearing at the output terminal of TX-8500II to a minimum.
9. Modulate the MPX SG output with 67.5kHz deviation at 1kHz for L + R, and the pilot signal (19kHz) with 7.5kHz deviation.
10. Next reduce the amount of distortion in the output signal from the TX-8500II to a minimum by adjusting the core of the front-end IF.

NOTE:
Signal at terminal No. 34 is 76kHz sawtooth wave and MPX SG pilot out is a 19kHz sinewave. These form a Lissajous' figure such as shown in Fig. 15.

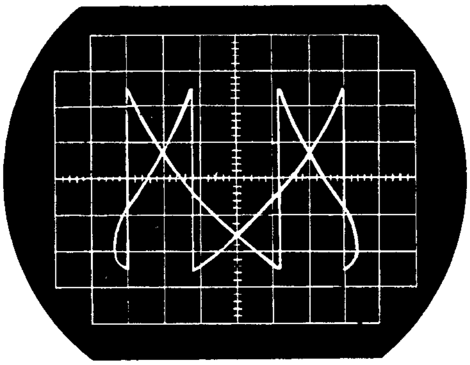


Fig. 15 Lissajous waveform

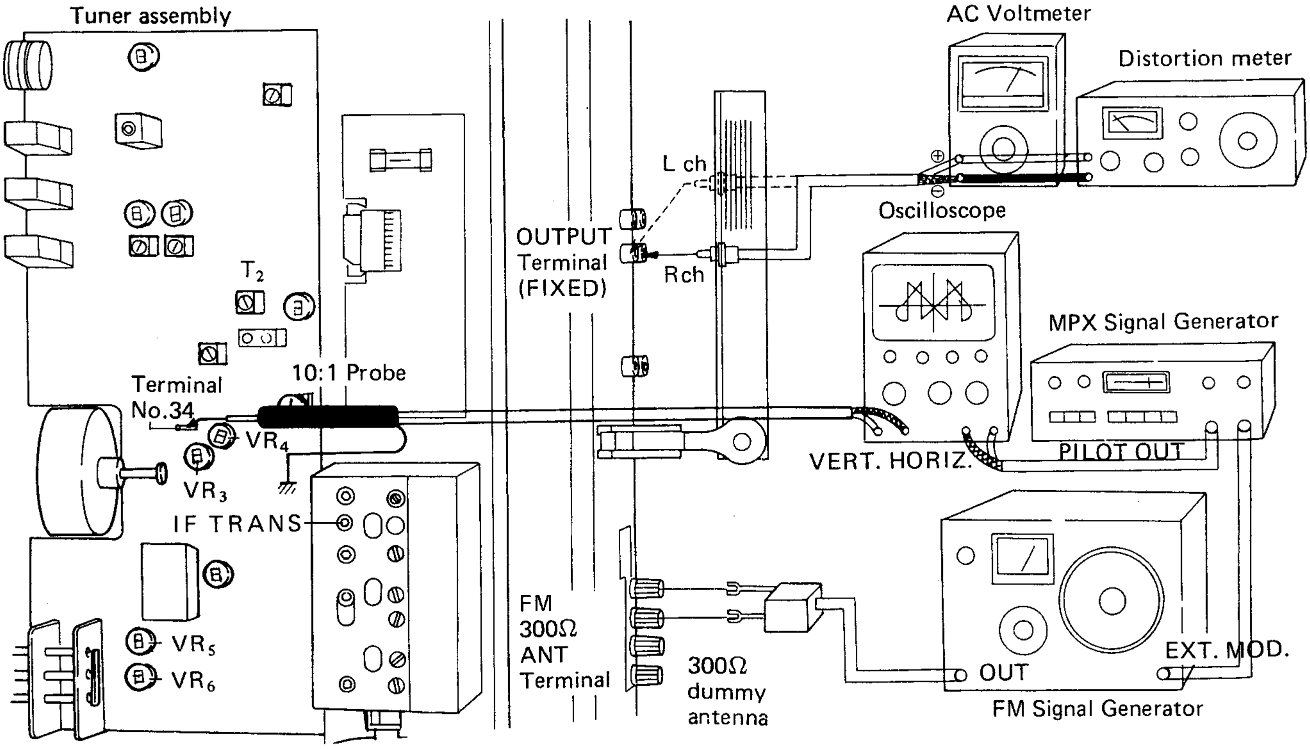

Tuner assembly
AC Voltmeter
Distortion meter
L ch
OUTPUT Terminal (FIXED)
Rch
Oscilloscope
MPX Signal Generator
T_2
Terminal No.34
10:1 Probe
VR_4
VR_3
IF TRANS
VR_5
VR_6
VERT. HORIZ.
PILOT OUT
FM 300Ω ANT Terminal
300Ω dummy antenna
OUT
EXT. MOD.
FM Signal Generator

Fig. 14

11. Change the IF BAND switch to the NARROW position, and then adjust the core of T_2 by less than ±90° in order to reduce distortion to a minimum.
12. Change the IF BAND switch back to the WIDE position, and switch main signal of the MPX SG to either L or R.
13. To obtain optimum channel separation, adjust VR_5.
14. Change the IF BAND switch back to the NARROW position again, and again adjust VR_6 to get optimum channel separation.
15. Turn the FUNCTION switch to the NOISE FILTER position, and check that channel separation lies in the 18dB ±3dB range. Also check that the STEREO indicator lamp goes off when in the FM MONO position, and that the signal has become monaural.

Adjustment of the REC LEVEL CHECK Oscillation Level

1. Connect up the test instruments as shown in Fig.16.
2. Turn the FUNCTION switch to FM AUTO.
3. With the FM SG at modulation frequency of 400Hz, 100% modulation, and an output of 60dB, check the output level of TX-8500II.
4. Turn the REC LEVEL CHECK to the ON position, and adjust VR_7 of the AF MPX assembly so that the output level is −6dB below the level found in step 3 above.

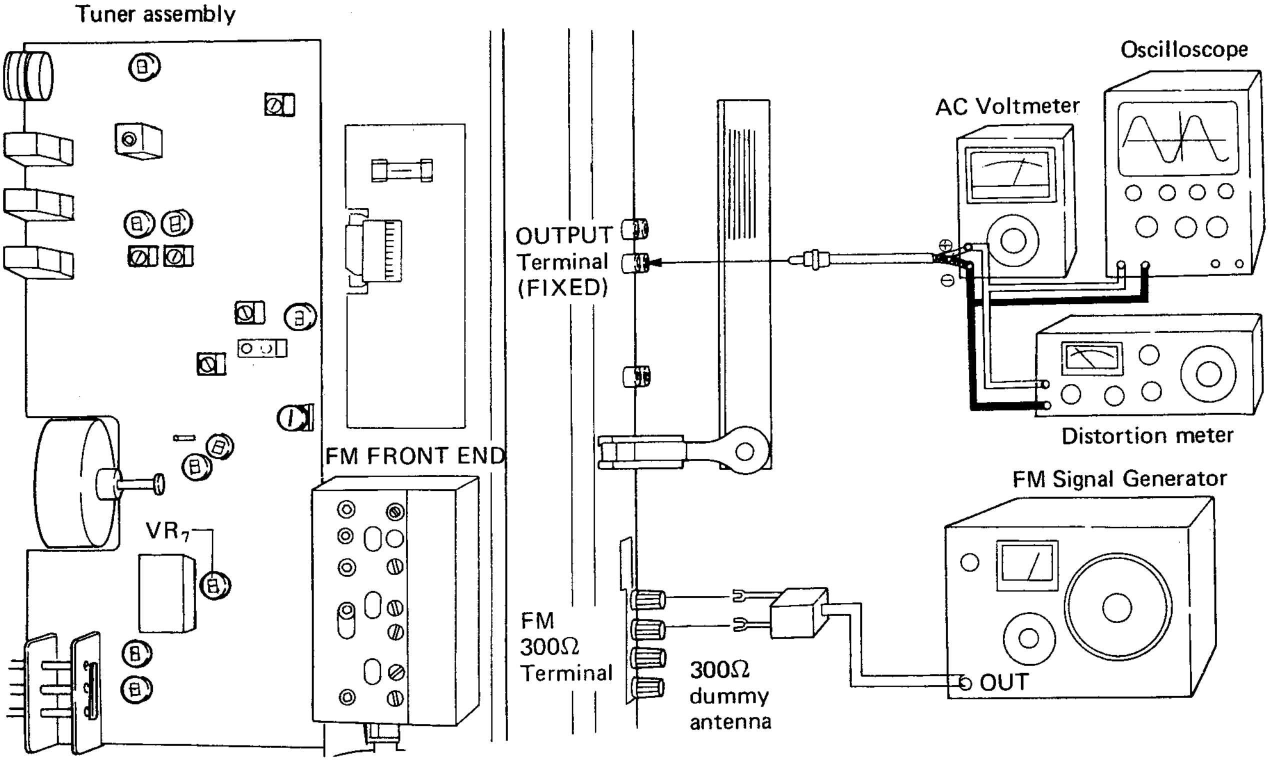

Tuner assembly
VR7
FM FRONT END
OUTPUT Terminal (FIXED)
FM 300Ω Terminal
300Ω dummy antenna
Oscilloscope
AC Voltmeter
⊕
⊖
Distortion meter
FM Signal Generator
OUT

Fig. 16

9.2 AM SECTION

Check that the dial indicator has been adjusted correctly to the starting point.

1. Turn the FUNCTION switch to the AM position.
2. Connect the test instruments as shown in Fig. 17, and adjust the AM Signal Generator (AM SG) to 400Hz modulation frequency, 30% modulation, and 30dB output.
3. Set the dial indicator of TX-8500II and AM SG to 600kHz, and then adjust the cores of T_4 and the bar antenna to gain the maximum output from TX-8500II.
4. Now set the dial indicator and AM SG to 1,400kHz, and again adjust for maximum output, but by means of the AM_2 and AM_1 trimmers.
5. With complete reception of the 600kHz and 1,400kHz signals, repeat steps 3 and 4 to minimize the amount of deviation between the two outputs.

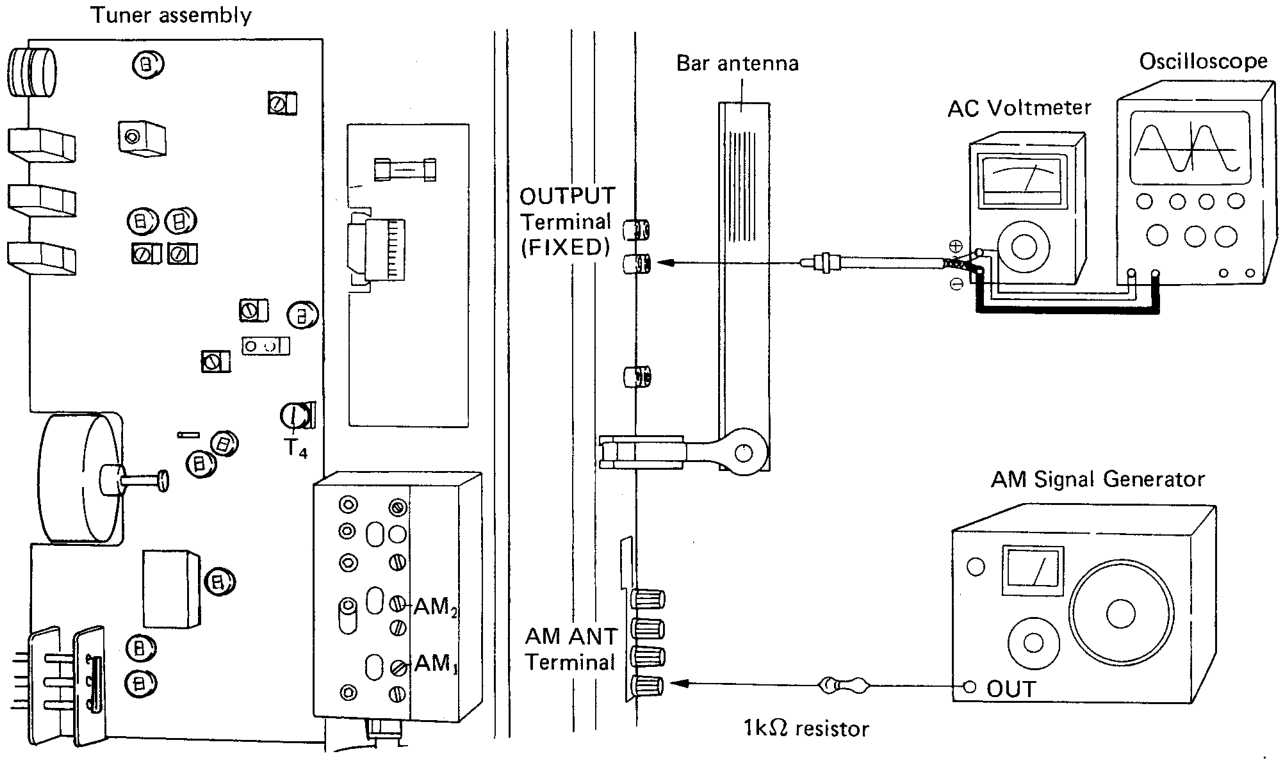
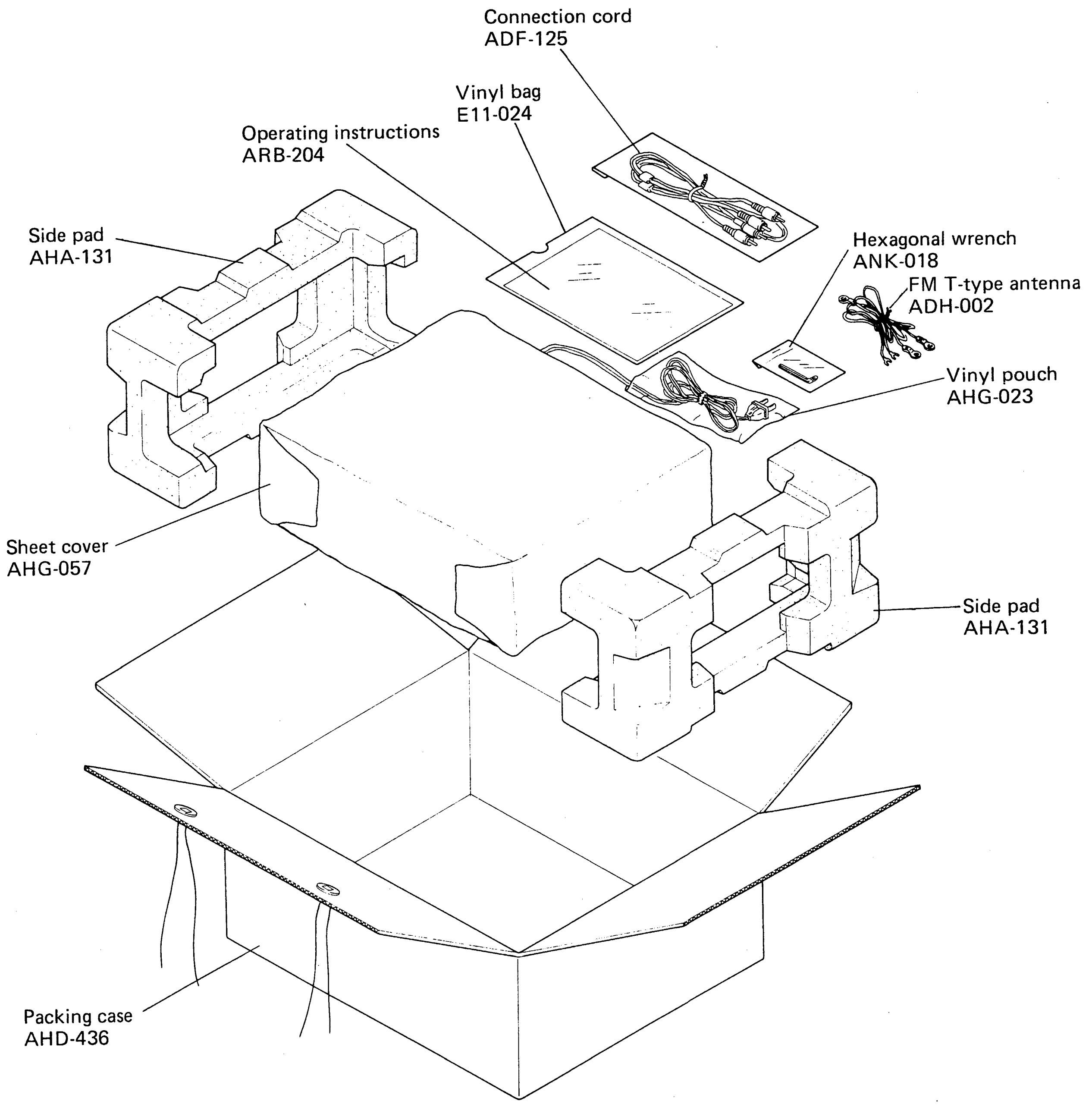

Tuner assembly
T_4
AM_2
AM_1
OUTPUT Terminal (FIXED)
AM ANT Terminal
Bar antenna
AC Voltmeter
Oscilloscope
⊕
⊖
AM Signal Generator
OUT
1kΩ resistor

Fig. 17

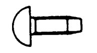
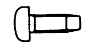
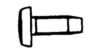
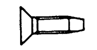
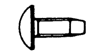
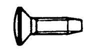
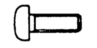
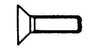
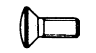
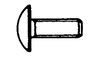
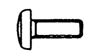
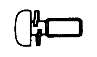
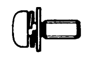
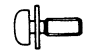
10. PACKING

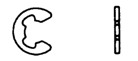
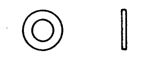
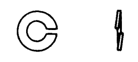
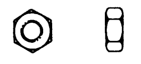
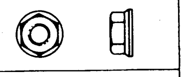
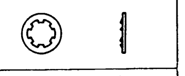
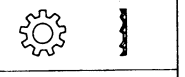
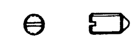
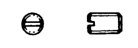
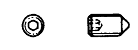
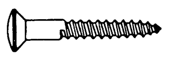
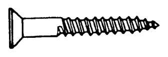
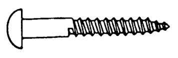

Connection cord
ADF-125
Vinyl bag
E11-024
Operating instructions
ARB-204
Side pad
AHA-131
Hexagonal wrench
ANK-018
FM T-type antenna
ADH-002
Vinyl pouch
AHG-023
Sheet cover
AHG-057
Side pad
AHA-131
Packing case
AHD-436

11. EXPLODED VIEWS

11.1 NOMENCLATURE OF SCREWS, WASHERS AND NUTS

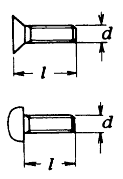
The following symbols stand for screws, washers and nuts as shown in exploded view.

Symbol	Description	Shape
RT	Brazier head tapping screw	
PT	Pan head tapping screw	
BT	Binding head tapping screw	
CT	Countersunk head tapping screw	
TT	Truss head tapping screw	
OCT	Oval countersunk head tapping screw	
PM	Pan head machine screw	
CM	Countersunk head machine screw	
OCM	Oval countersunk head machine screw	
TM	Truss head machine screw	
BM	Binding head machine screw	
PSA	Pan head screw with spring lock washer	
PSB	Pan head screw with spring lock washer and flat washer	
PSF	Pan head screw with flat washer	

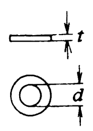
Symbol	Description	Shape
EW	E type washer	
FW	Flat washer	
SW	Spring lock washer	
N	Nut	
WN	Washer faced nut	
ITW	Internal toothed lock washer	
OTW	Outernal toothed lock washer	
SC	Slotted set screw (Cone point)	
SF	Slotted set screw (Flat point)	
HS	Hexagon socket headless set screw	
OCW	Oval countersunk head wood screw	
CW	Countersunk head wood screw	
RW	Round head wood screw	

EXAMPLE

PM 3x8
length in mm (*l*)
diameter in mm (*d*)
Symbol

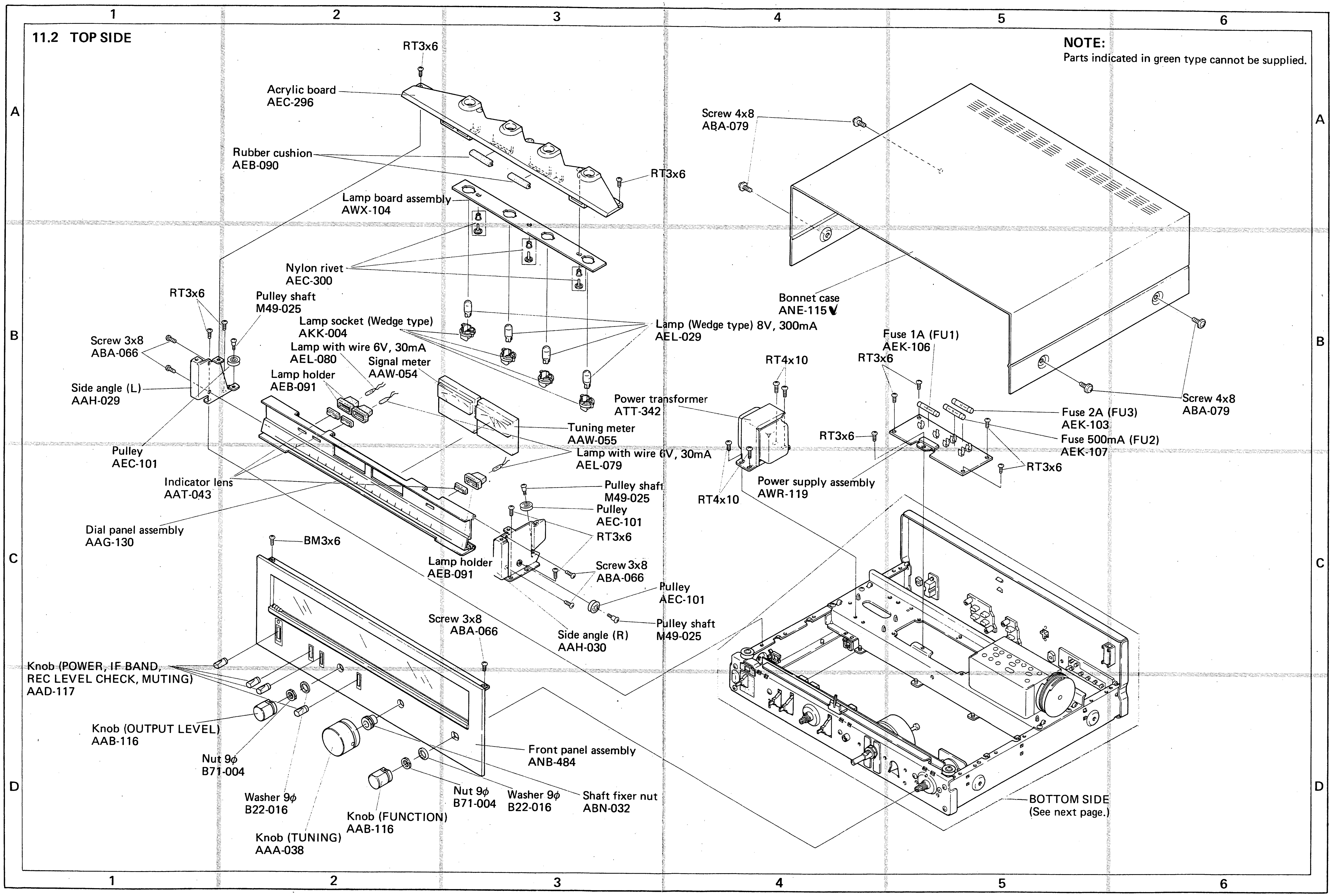


FW 9ϕx1^t
thickness in mm (*t*)
diameter in mm (*d*)
Symbol



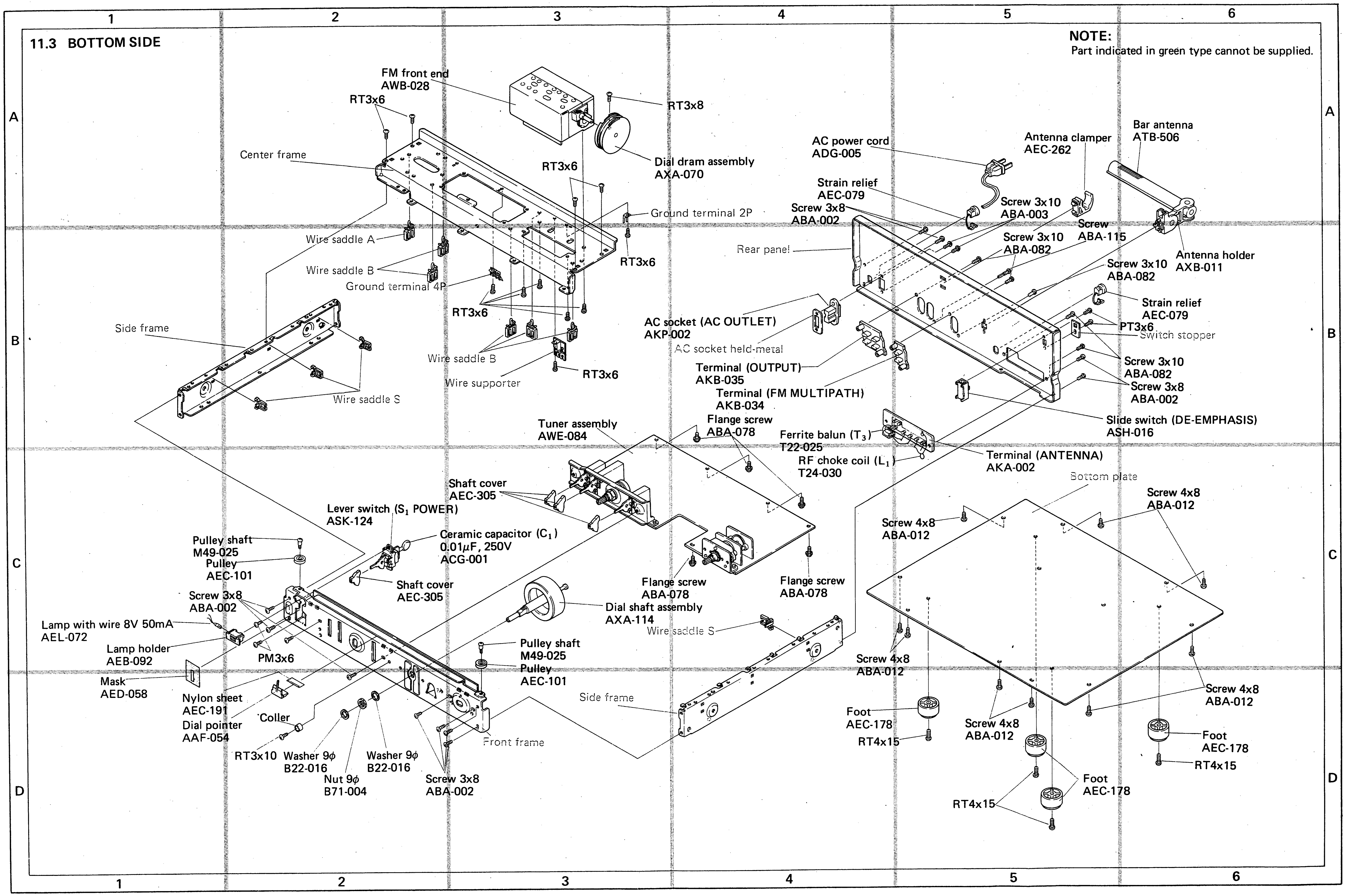
11.2 TOP SIDE

NOTE:
Parts indicated in green type cannot be supplied.


1
2
3
4
5
6
A
B
C
D
RT3x6
Acrylic board
AEC-296
Rubber cushion
AEB-090
RT3x6
Lamp board assembly
AWX-104
Nylon rivet
AEC-300
RT3x6
Pulley shaft
M49-025
Lamp socket (Wedge type)
AKK-004
Screw 3x8
ABA-066
Lamp with wire 6V, 30mA
AEL-080
Signal meter
AAW-054
Lamp holder
AEB-091
Side angle (L)
AAH-029
Pulley
AEC-101
Indicator lens
AAT-043
Dial panel assembly
AAG-130
BM3x6
Lamp (Wedge type) 8V, 300mA
AEL-029
Tuning meter
AAW-055
Lamp with wire 6V, 30mA
AEL-079
Pulley shaft
M49-025
Pulley
AEC-101
RT3x6
Lamp holder
AEB-091
Screw 3x8
ABA-066
Pulley
AEC-101
Pulley shaft
M49-025
Screw 3x8
ABA-066
Side angle (R)
AAH-030
Knob (POWER, IF BAND, REC LEVEL CHECK, MUTING)
AAD-117
Knob (OUTPUT LEVEL)
AAB-116
Nut 9ϕ
B71-004
Washer 9ϕ
B22-016
Knob (TUNING)
AAA-038
Knob (FUNCTION)
AAB-116
Nut 9ϕ
B71-004
Washer 9ϕ
B22-016
Shaft fixer nut
ABN-032
Front panel assembly
ANB-484
Screw 4x8
ABA-079
Bonnet case
ANE-115
RT4x10
Fuse 1A (FU1)
AEK-106
RT3x6
Power transformer
ATT-342
RT3x6
RT4x10
Power supply assembly
AWR-119
Fuse 2A (FU3)
AEK-103
Fuse 500mA (FU2)
AEK-107
RT3x6
Screw 4x8
ABA-079
BOTTOM SIDE
(See next page.)

11.3 BOTTOM SIDE

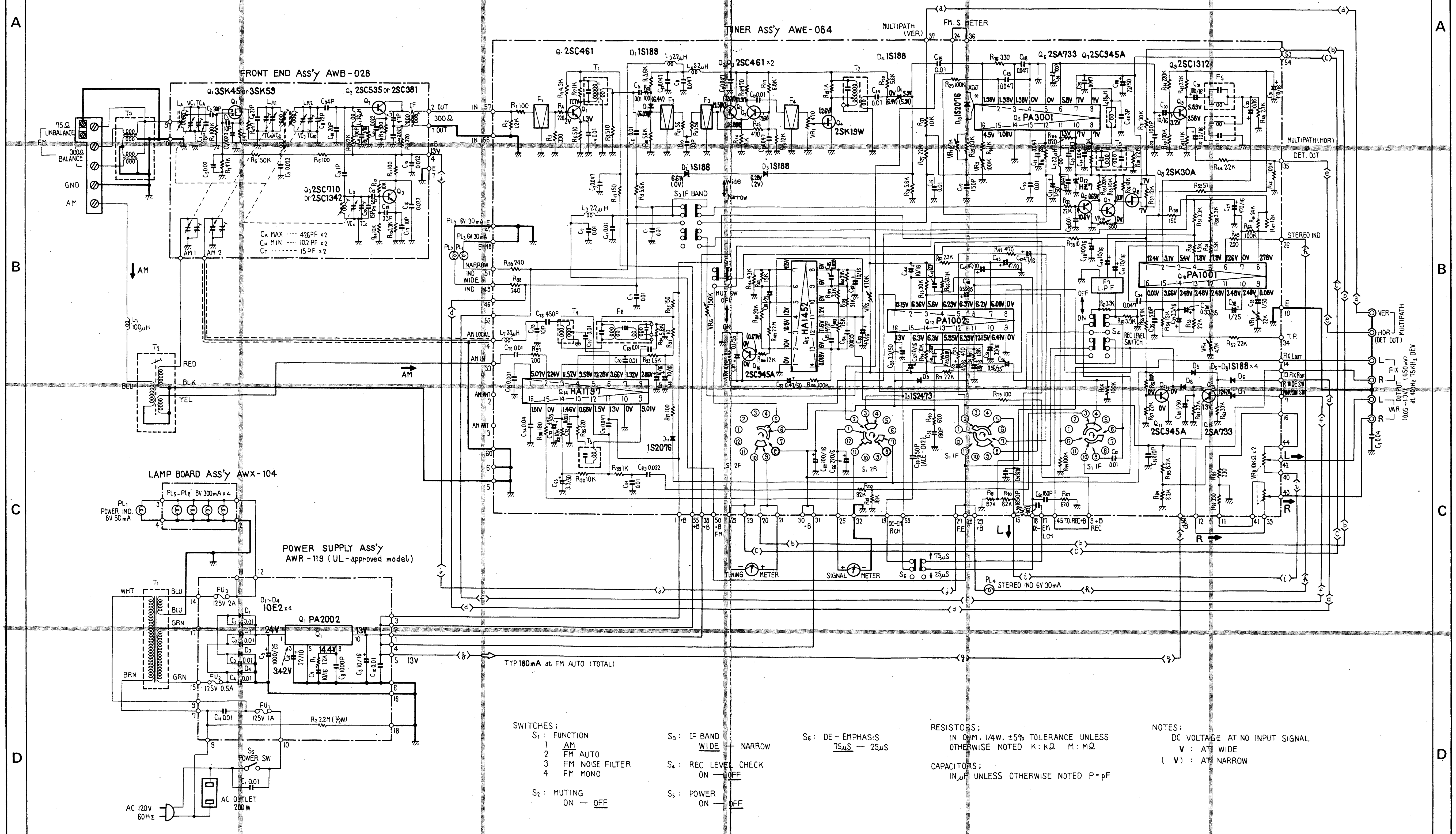
NOTE:
Part indicated in green type cannot be supplied.


1
2
3
4
5
6
A
B
C
D
FM front end
AWB-028
RT3x6
RT3x8
Center frame
Dial dram assembly
AXA-070
RT3x6
Ground terminal 2P
Wire saddle A
Wire saddle B
Ground terminal 4P
RT3x6
RT3x6
Side frame
Wire saddle B
Wire supporter
RT3x6
Wire saddle S
AC power cord
ADG-005
Antenna clamper
AEC-262
Bar antenna
ATB-506
Strain relief
AEC-079
Screw 3x8
ABA-002
Screw 3x10
ABA-003
Screw
ABA-115
Screw 3x10
ABA-082
Rear panel
Antenna holder
AXB-011
Screw 3x10
ABA-082
Strain relief
AEC-079
PT3x6
Switch stopper
AC socket (AC OUTLET)
AKP-002
AC socket held-metal
Terminal (OUTPUT)
AKB-035
Terminal (FM MULTIPATH)
AKB-034
Screw 3x10
ABA-082
Screw 3x8
ABA-002
Slide switch (DE-EMPHASIS)
ASH-016
Tuner assembly
AWE-084
Flange screw
ABA-078
Ferrite balun (T$_3$)
T22-025
RF choke coil (L$_1$)
T24-030
Terminal (ANTENNA)
AKA-002
Bottom plate
Shaft cover
AEC-305
Lever switch (S$_1$ POWER)
ASK-124
Ceramic capacitor (C$_1$)
0.01μF, 250V
ACG-001
Screw 4x8
ABA-012
Screw 4x8
ABA-012
Pulley shaft
M49-025
Pulley
AEC-101
Shaft cover
AEC-305
Flange screw
ABA-078
Flange screw
ABA-078
Screw 3x8
ABA-002
Dial shaft assembly
AXA-114
Lamp with wire 8V 50mA
AEL-072
Lamp holder
AEB-092
PM3x6
Wire saddle S
Pulley shaft
M49-025
Pulley
AEC-101
Screw 4x8
ABA-012
Mask
AED-058
Nylon sheet
AEC-191
Dial pointer
AAF-054
Coller
Side frame
Screw 4x8
ABA-012
Foot
AEC-178
RT4x15
Screw 4x8
ABA-012
Front frame
Foot
AEC-178
RT4x15
RT3x10
Washer 9φ
B22-016
Washer 9φ
B22-016
Nut 9φ
B71-004
Screw 3x8
ABA-002
Foot
AEC-178
RT4x15

12. SCHEMATIC DIAGRAMS, P.C. BOARD PATTERNS AND PARTS LIST

12.1 SCHEMATIC DIAGRAM AND MISCELLANEOUS PARTS LIST

NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.


TUNER ASS'Y AWE-084
FRONT END ASS'Y AWB-028
Q1 3SK45 or 3SK59
Q2 2SC535 or 2SC381
Q3 2SC710 or 2SC1342
CK MAX ···· 426PF x2
CK MIN ···· 10.2PF x2
CT ········ 15PF x2
75Ω UNBALANCE
FM
300Ω BALANCE
GND
AM
AM 1
AM 2
IF OUT
300Ω
Q1 2SC461
D1 1S188
Q2, Q3 2SC461 x2
Q4 2SK19W
D4 1S188
D2 1S188
D3 1S188
S3 IF BAND
Wide
Narrow
Q5 PA3001
Q6 2SA733
Q7 2SC945A
Q8 2SC1312
Q9 2SK30A
Q10 PA1001
Q12 PA1002
Q13 HA1452
Q14 HA1197
2SC945A
1S2076
D6 1S2076
D11 1S2076
1S2473
L.P.F
S4 REC LEVEL SWITCH
D5-D8 1S188 x4
Q11 2SC945A
2SA733
MULTIPATH (VER)
FM. S METER
MULTIPATH (HOR)
DET. OUT
STEREO IND
VER
HOR (DET OUT)
MULTIPATH
FIX
VAR
OUTPUT 650mV (100%-1kHz 75kHz DEV)
T.P.
FIX Lout
FIX Rout
WIDE SW
NARROW SW
AM LOCAL
AM IN
AM ANT
NARROW IND
WIDE IND
PL2 6V 30mA
PL3 6V 30mA
TUNING METER
SIGNAL METER
S6
75μS
25μS
PL4 STEREO IND 6V 30mA
DE-EM RCH
DE-EM LCH
45 TO. REC +B
REC
LAMP BOARD ASS'Y AWX-104
PL5-PL8 8V 300mA x4
PL1 POWER IND 8V 50mA
POWER SUPPLY ASS'Y AWR-119 (UL-approved model)
T1
WHT
BLU
GRN
BRN
FU3 125V 2A
FU2 125V 0.5A
FU1 125V 1A
D1-D4 10E2 x4
Q1 PA2002
24V
13V
14.4V
34.2V
13V
TYP 180mA at FM AUTO (TOTAL)
R2 2.2M (1/2W)
C11 0.01
S5 POWER SW
C1 0.01
AC OUTLET 200W
AC 120V 60Hz
T2
RED
BLK
YEL
L1 100μH
AM

SWITCHES;
S₁ : FUNCTION
1 AM
2 FM AUTO
3 FM NOISE FILTER
4 FM MONO

S₂ : MUTING
ON — OFF

S₃ : IF BAND
WIDE — NARROW

S₄ : REC LEVEL CHECK
ON — OFF

S₅ : POWER
ON — OFF

S₆ : DE-EMPHASIS
75μS — 25μS

RESISTORS;
IN OHM, 1/4W, ±5% TOLERANCE UNLESS OTHERWISE NOTED K : kΩ M : MΩ

CAPACITORS;
IN μF UNLESS OTHERWISE NOTED P = pF

NOTES;
DC VOLTAGE AT NO INPUT SIGNAL
V : AT WIDE
(**V**) : AT NARROW

Miscellaneous Parts List

NOTE:
- *Capacitors: in μF unless otherwise noted p:pF*
- *Resistors: in Ω, ¼W unless otherwise noted k:kΩ, M:MΩ*

SWITCHES

Symbol	Description	Part No.
S5	Lever switch (POWER)	ASK-124
S6	Slide switch (DE-EMPHASIS)	ASH-016

TRANSFORMERS AND COIL

Symbol	Description	Part No.
T1	Power transformer	ATT-342
T2	Bar antenna	ATB-506
T3	Ferrite balun	T22-025
L1	RF choke coil	T24-030

LAMPS

Symbol	Description	Part No.
PL1	Lamp with wire 8V, 50mA	AEL-072
PL2	Lamp with wire 6V, 30mA	AEL-080
PL3	Lamp with wire 6V, 30mA	AEL-079
PL4	Lamp with wire 6V, 30mA	AEL-079
PL5	Lamp (Wedge type) 8V, 300mA	AEL-029
PL6	Lamp (Wedge type) 8V, 300mA	AEL-029
PL7	Lamp (Wedge type) 8V, 300mA	AEL-029
PL8	Lamp (Wedge type) 8V, 300mA	AEL-029

FUSES

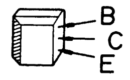
Symbol	Description	Part No.
FU1	Fuse 1A (Primary)	AEK-106
FU2	Fuse 500mA (Secondary)	AEK-107
FU3	Fuse 2A (Secondary)	AEK-103

CAPACITORS

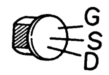
Symbol	Description			Part No.
C1	Ceramic	0.01	250V	ACG-001
C2	Ceramic	0.04	50V	CKDYF 403Z 50

External Appearances of Transistors and ICs

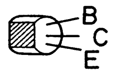
2SC461



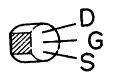
2SK19



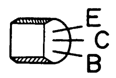
2SA733
2SC945A



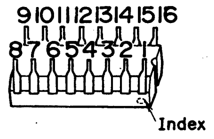
2SK30A



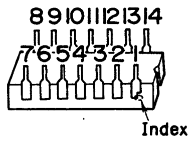
2SC1312



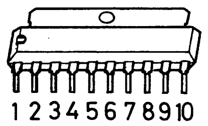
PA1002
PA3001
PA1001
HA1197


9 10 11 12 13 14 15 16
8 7 6 5 4 3 2 1
Index

HA1452W

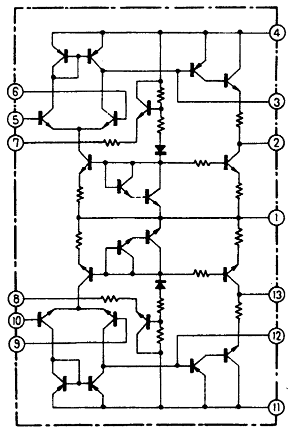

8 9 10 11 12 13 14
7 6 5 4 3 2 1
Index

PA2002

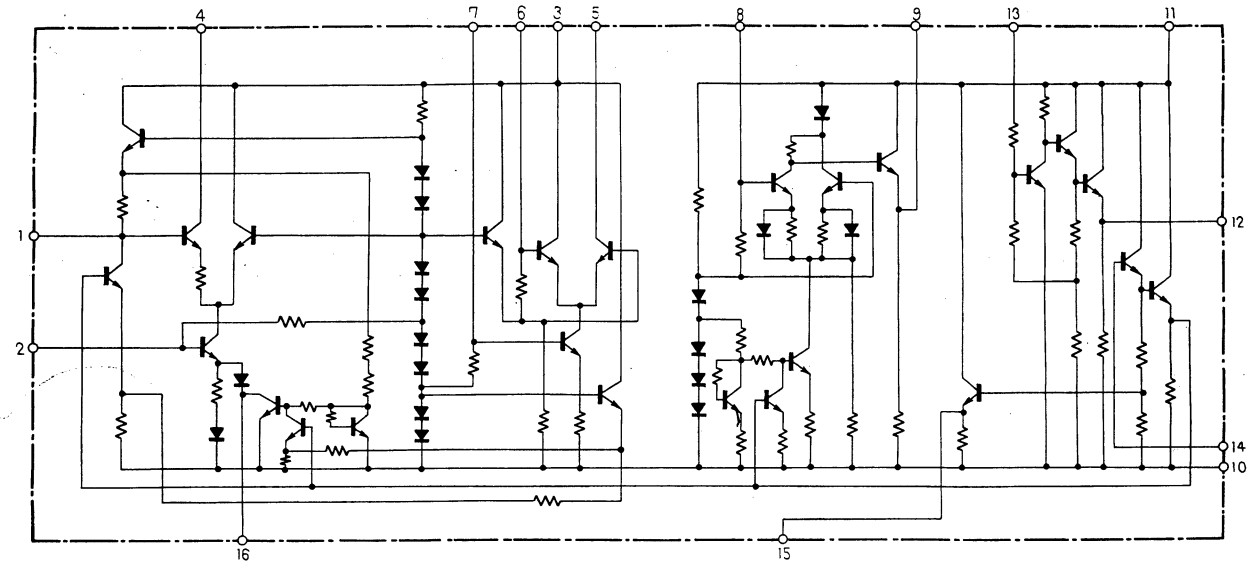

1 2 3 4 5 6 7 8 9 10

Circuit Diagrams of ICs

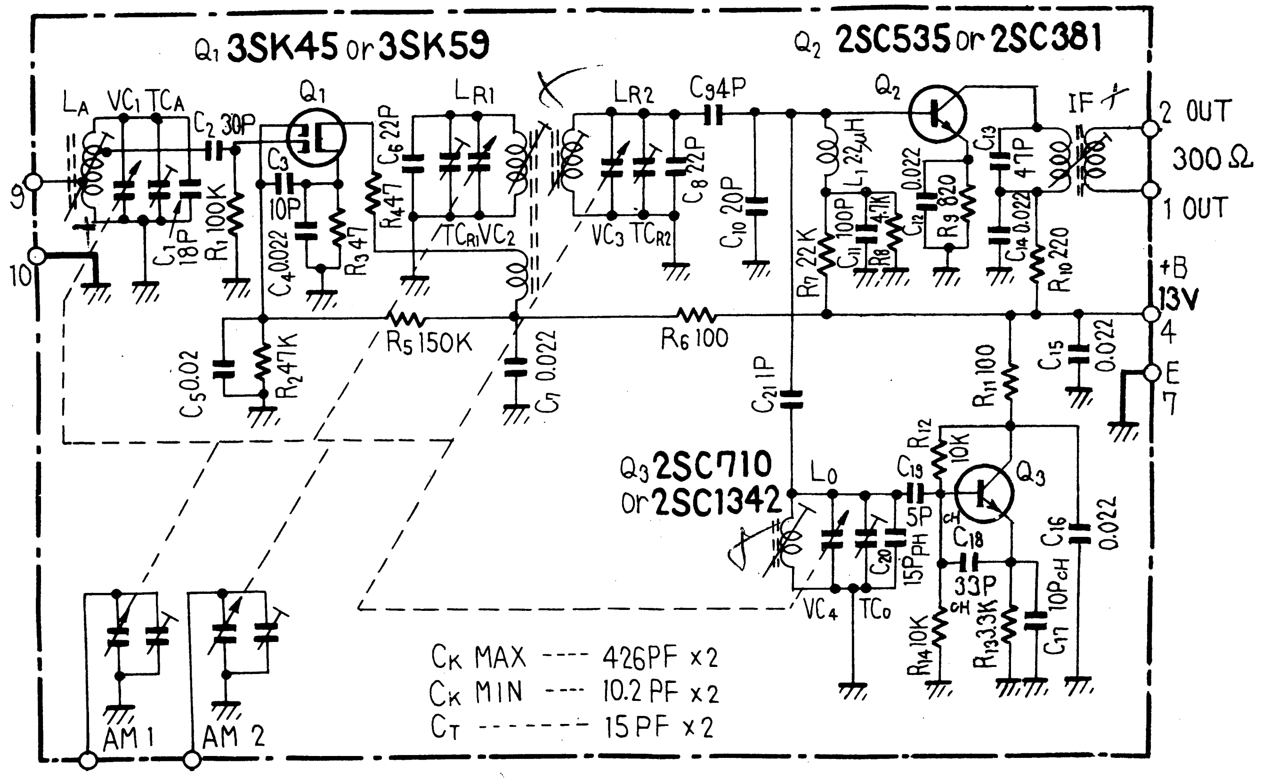
HA1452W


4
6
5
7
3
2
1
8
10
9
13
12
11

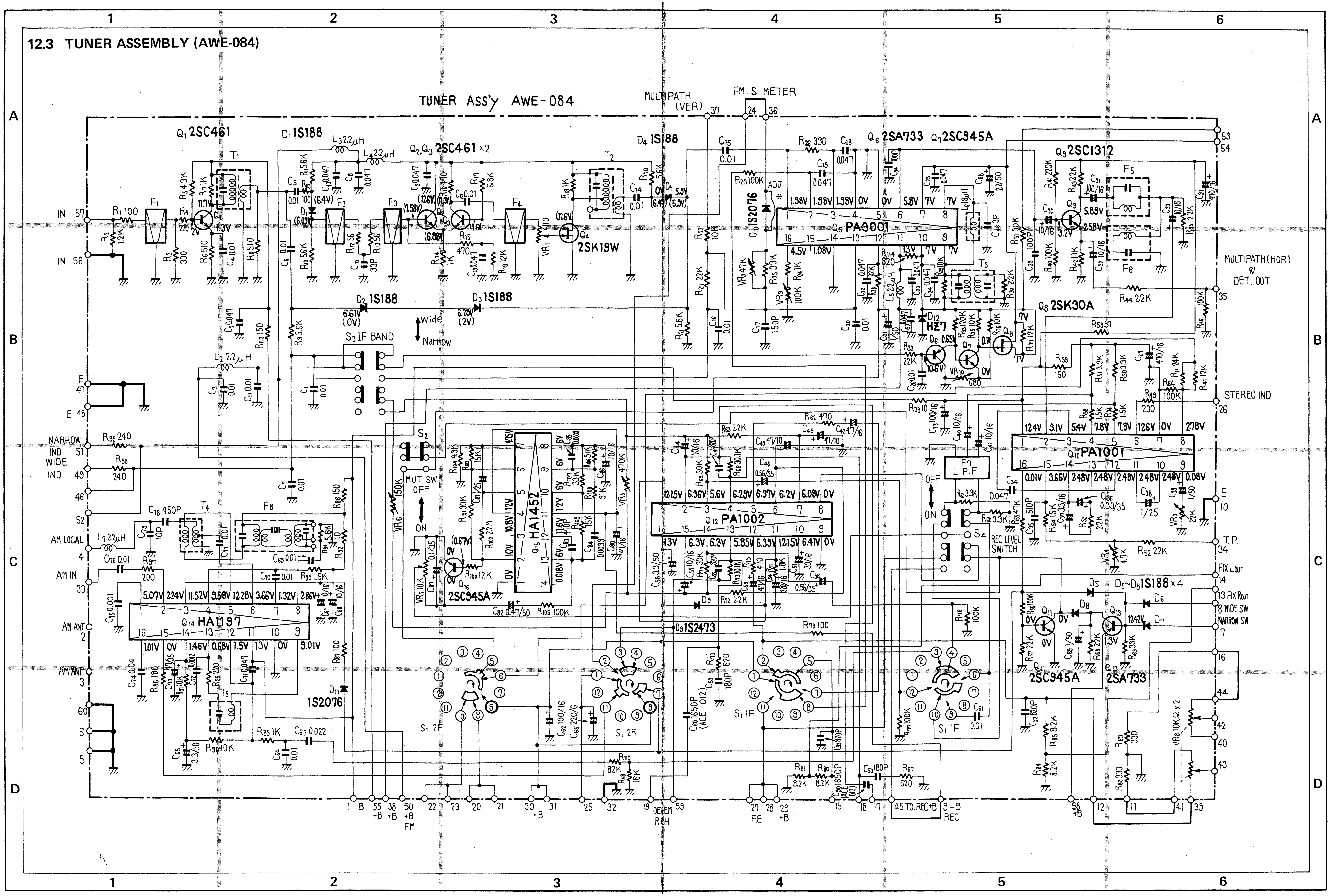
HA1197 (AM IC)

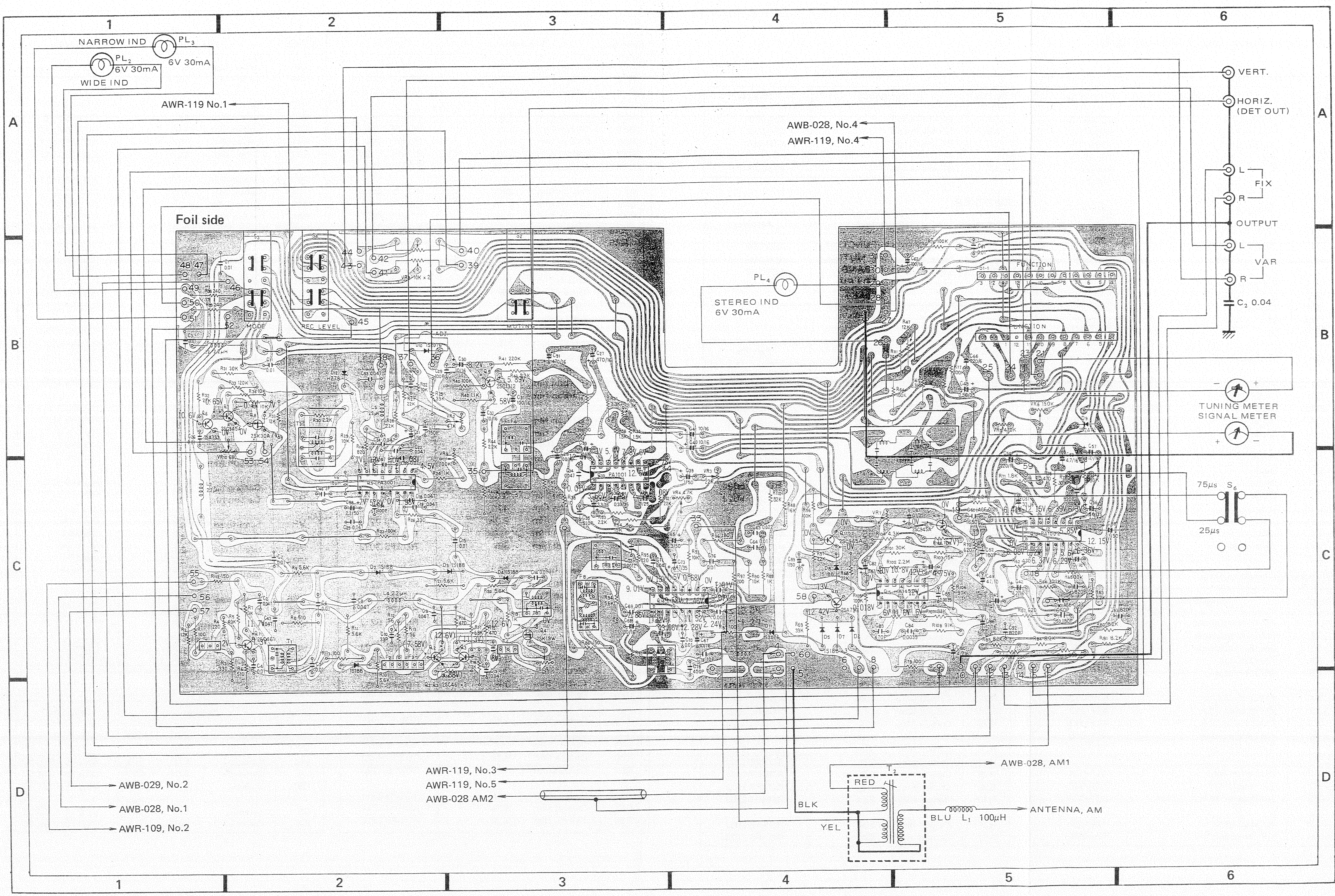

4
7
6
3
5
8
9
13
11
1
2
12
14
10
16
15

12.2 FM FRONT END (AWB-028)


Q1 3SK45 or 3SK59
Q2 2SC535 or 2SC381
LA
VC1
TCA
C2 30P
Q1
C3
10P
C1 18P
R1 100K
C4 0.022
R3 47
R4 47
C6 22P
LR1
TCR
VC2
LR2
C9 4P
C8 22P
VC3
TCR2
C10 20P
Q2
L1 22μH
C11 100P
R8 4.7K
C12 0.022
R9 820
C13 47P
C14 0.022
R10 220
R7 22K
IF
2 OUT
300 Ω
1 OUT
+B
13V
4
E
7
9
10
C5 0.02
R2 47K
R5 150K
C7 0.022
R6 100
C21 1P
R11 100
C15 0.022
Q3 2SC710 or 2SC1342
LO
C19
R12 10K
Q3
5P
C18
33P
C20 15P
C16 0.022
C17 10P
R13 3.3K
R14 10K
VC4
TCO
AM 1
AM 2
CK MAX ---- 426PF x2
CK MIN ---- 10.2 PF x2
CT ------- 15PF x2

12.3 TUNER ASSEMBLY (AWE-084)


TUNER ASS'Y AWE-084
MULTIPATH (VER) 37
FM. S. METER 24 36
Q1 2SC461
D1 1S188
L3 2.2μH
L4 2.2μH
Q2, Q3 2SC461 ×2
D4 1S188
Q6 2SA733
Q7 2SC945A
Q9 2SC1312
Q5 PA3001
D10 1S2076
ADJ
T1
T2
T3
F1
F2
F3
F4
F5
F6
Q4 2SK19W
D2 1S188
D3 1S188
S3 IF BAND
Wide
Narrow
L2 2.2μH
D12 HZ7
Q8 2SK30A
MULTIPATH(HOR) & DET. OUT 35
STEREO IND 26
Q10 PA1001
F7 L.P.F
Q12 PA1002
REC LEVEL SWITCH
S4
Q15 HA1452
Q16 2SC945A
S2
MUT SW OFF ON
VR6 150K
VR5 470K
Q14 HA1197
T4
T5
F8
L7 2.2μH
D11 1S2076
D9 1S2473
D5~D8 1S188 ×4
Q11 2SC945A
Q13 2SA733
VR8 10KΩ×2
IN 57
IN 56
E 47
E 48
NARROW IND 51
WIDE IND 49
46
52
AM LOCAL 4
AM IN 33
AM ANT 2
AM ANT 3
60
6
5
53
54
E 10
T.P. 34
FIX Lout 14
13 FIX Rout
8 WIDE SW
NARROW SW 7
16
44
42
40
43
S1 2F
S1 2R
S1 1F
1 B
55 +B
38 +B
50 +B FM
22 23 20 21
30 31 +B
25 32
19 DE-EM R.CH 59
27 F.E 28
29 +B
15 18 17
45 TO. REC+B
9 +B REC
58 +B
12 11 41 39
1 2 3 4 5 6
A B C D


1
2
3
4
5
6
A
B
C
D
NARROW IND
PL3
6V 30mA
PL2
6V 30mA
WIDE IND
AWR-119 No.1
AWB-028, No.4
AWR-119, No.4
VERT.
HORIZ.
(DET OUT)
L
R
FIX
OUTPUT
L
R
VAR
C2 0.04
Foil side
MODE
REC LEVEL
MUTING
FUNCTION
PL4
STEREO IND
6V 30mA
TUNING METER
SIGNAL METER
75µs
S6
25µs
PA1001
PA3001
AWR-119, No.3
AWR-119, No.5
AWB-028 AM2
AWB-029, No.2
AWB-028, No.1
AWR-109, No.2
AWB-028, AM1
T2
RED
BLK
YEL
BLU
L1
100µH
ANTENNA, AM

Parts List of Tuner Assembly (AWE-084)

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	Transistor	2SC461-B
Q2	Transistor	2SC461-B
Q3	Transistor	2SC461-B
Q4	FET	2SK19-W
* Q5	IC	PA3001 (PA3001Y)
Q6	Transistor	2SA733-Q
Q7	Transistor	2SC945A-Q
Q8	FET	2SK30A-Y
Q9	Transistor	2SC1312-G
Q10	IC	PA1001
Q11	Transistor	2SC945A-Q
Q12	IC	PA1002
Q13	Transistor	2SA733-Q
Q14	IC	HA1197
Q15	IC	HA1452W
Q16	Transistor	2SC945A-Q
D1	Diode	1S188FM-1
D2	Diode	1S188FM-1
D3	Diode	1S188FM-1
D4	Diode	1S188FM-1
D5	Diode	1S188FM-1
D6	Diode	1S188FM-1
D7	Diode	1S188FM-1
D8	Diode	1S188FM-1
D9	Diode	1S2473
* D10	Diode	1S2076
D11	Diode	1S2076
D12	Zener diode	HZ7-B

TRANSFORMERS, COILS

Symbol	Description	Part No.
T1	FM IF transformer	ATE-023
T2	FM IF transformer	ATE-024
T3	FM IF transformer	T73-035
T4	AM OSC coil	ATB-019
T5	455kHz filter	ATF-038
F1	FM ceramic filter	ATF-013
F2	FM ceramic filter	ATF-013
F3	FM ceramic filter	ATF-013
F4	FM ceramic filter	ATF-013
F5	Anti-birdy filter	ATF-023
F6	Anti-birdy filter	ATF-024
F7	Low pass filter	ATF-036
F8	AM ceramic filter	ATF-034
L2	RF choke coil	T24-028
L3	RF choke coil	T24-028
L4	RF choke coil	T24-028
L5	RF choke coil	T24-028
L6	RF choke coil	ATH-007
L7	RF choke coil	T24-028

SWITCHES

Symbol	Description	Part No.
S1	Rotary switch (FUNCTION)	ASD-063
S2	Lever switch (FM MUTING)	ASK-109
S3	Lever switch (IF BAND)	ASK-112
S4	Lever switch (REC LEVEL CHECK)	ASK-112

RESISTORS

Symbol	Description	Part No.
R1	Carbon film 100	RD¼PS 101J
R2	Carbon film 1.2k	RD¼PS 122J
R3	Carbon film 330	RD¼PS 331J
R4	Carbon film 220	RD¼PS 221J
R5	Carbon film 4.3k	RD¼PS 432J
R6	Carbon film 510	RD¼PS 511J
R7	Carbon film 1k	RD¼PS 102J
R8	Carbon film 510	RD¼PS 511J
R9	Carbon film 5.6k	RD¼PS 562J
R10	Carbon film 5.6k	RD¼PS 562J
R11	Carbon film 5.6k	RD¼PS 562J
R12	Carbon film 56	RD¼PS 560J
R13	Carbon film 56	RD¼PS 560J
R14	Carbon film 1k	RD¼PS 102J
R15	Carbon film 470	RD¼PS 471J
R16	Carbon film 470	RD¼PS 471J
R17	Carbon film 6.8k	RD¼PS 682J
R18	Carbon film 12k	RD¼PS 123J
R19	Carbon film 1k	RD¼PS 102J
R20	Carbon film 5.6k	RD¼PS 562J
R21	Carbon film 5.6k	RD¼PS 562J
R22	Carbon film 10k	RD¼PS 103J
R23	Carbon film 100k	RD¼PS 104J
R24	Carbon film 1k	RD¼PS 102J
R25	Carbon film 33k	RD¼PS 333J
R26	Carbon film 330	RD¼PS 331J
R27	Carbon film 22k	RD¼PS 223J
R28	Carbon film 2.2k	RD¼PS 222J
R29	Carbon film 10k	RD¼PS 103J
R30	Carbon film 2.2k	RD¼PS 222J
R31	Carbon film 30k	RD¼PS 303J
R32	Carbon film 22k	RD¼PS 223J
R33	Carbon film 120k	RD¼PS 124J
R34	Carbon film 1.5k	RD¼PS 152J
R35	Carbon film 10k	RD¼PS 103J
R36	Carbon film 10k	RD¼PS 103J
R37	Carbon film 12k	RD¼PS 123J
R38	Carbon film 10	RD¼PS 100J
R39	Carbon film 150	RD¼PS 151J
R40	Carbon film 100k	RD¼PS 104J
R41	Carbon film 220k	RD¼PS 224J
R42	Carbon film 1.1k	RD¼PS 112J
R43	Carbon film 2.2k	RD¼PS 222J
R44	Carbon film 2.2k	RD¼PS 222J
R45	Carbonf ilm 2.2k	RD¼PS 222J
R46	Carbon film 100k	RD¼PS 104J
R47	Carbon film 12k	RD¼PS 123J
R48	Carbon film 16k	RD¼PS 163J
R49	Carbon film 200	RD¼PS 201J
R50	Metal film 3.3k ⅕W	RN⅕SQ 3301F
R51	Metal film 3.3k ⅕W	RN⅕SQ 3301F
R52	Carbon film 22k	RD¼PS 223J
R53	Carbon film 2.2k	RD¼PS 222J
R54	Carbon film 15k	RD¼PS 153J
R55	Carbon film 47k	RD¼PS 473J
R56	Carbon film 100k	RD¼PS 104J
R57	Carbon film 22k	RD¼PS 223J
R58	Carbon film 1.5k	RD¼PS 152J
R59	Carbon film 51	RD¼PS 510J
R60	Carbon film 3.3k	RD¼PS 332J
R61	Carbon film 3.3k	RD¼PS 332J
R62	Carbon film 470	RD¼PS 471J
R63	Carbon film 2.2k	RD¼PS 222J
R64	Carbon film 100k	RD¼PS 104J
R65	Carbon film 30k	RD¼PS 303J
R66	Metal film 30.1k ⅕W	RN⅕SQ 3012F
R67	Carbon film 620	RD¼PS 621J
R68	Carbon film 22k	RD¼PS 223J
R69	Carbon film 33k	RD¼PS 333J
R70	Carbon film 620	RD¼PS 621J
R71	Carbon film 1.8k	RD¼PS 182J
R72	Carbon film 2.2k	RD¼PS 222J
R73	Metal film 30.1K ⅕W	RN⅕SQ 3012F
R74	Carbon film 30k	RD¼PS 303J
R75	Carbon film 470	RD¼PS 471J
R76	Carbon film 100k	RD¼PS 104J
R77	Carbon film 100k	RD¼PS 104J
R79	Carbon film 100	RD¼PS 101J
R80	Carbon film 8.2k	RD¼PS 822J
R81	Carbon film 8.2k	RD¼PS 822J
R82	Carbon film 330	RD¼PS 331J
R83	Carbon film 330	RD¼PS 331J
R84	Carbon film 8.2k	RD¼PS 822J
R85	Carbon film 8.2k	RD¼PS 822J
R86	Carbon film 150	RD¼PS 151J
R87	Carbon film 100	RD¼PS 101J
R89	Carbon film 1k	RD¼PS 102J
R90	Carbon film 10k	RD¼PS 103J
R91	Carbon film 10k	RD¼PS 103J
R92	Carbon film 10	RD¼PS 100J
R93	Carbon film 1.5k	RD¼PS 152J
R94	Carbon film 5.6k	RD¼PS 562J
R95	Carbon film 220	RD¼PS 221J
R96	Carbon film 180	RD¼PS 181J
R97	Carbon film 200	RD¼PS 201J
R98	Carbon film 240	RD¼PS 241J
R99	Carbon film 240	RD¼PS 241J
R100	Carbon film 12k	RD¼PS 123J
R101	Carbon film 30k	RD¼PS 303J
R102	Carbon film 2.2M	RD¼PS 225J
R103	Carbon film 15k	RD¼PS 153J
R104	Carbon film 4.3k	RD¼PS 432J
R105	Carbon film 100k	RD¼PS 104J
R106	Carbon film 91k	RD¼PS 913J
R107	Carbon film 33k	RD¼PS 333J
R108	Carbon film 91k	RD¼PS 913J
R109	Carbon film 75k	RD¼PS 753J
R110	Carbon film 82k	RD¼PS 823J
R111	Carbon film 24k	RD¼PS 243J
R112	Carbon film 150	RD¼PS 151J
R113	Carbon film 100	RD¼PS 101J
R114	Carbon film 820	RD¼PS 821J
VR1	Semi-fixed 470	ACP-006
VR2	Semi-fixed 47k	C92-048
VR3	Semi-fixed 22k	ACP-056
VR4	Semi-fixed 4.7k	C92-051
VR5	Semi-fixed 470k	ACP-011
VR6	Semi-fixed 150k	ACP-057
VR7	Semi-fixed 10k	C92-049
VR8	Variable resistor 10k (OUTPUT LEVEL)	ACV-178
VR9	Semi-fixed 100k	C92-047
VR10	Semi-fixed 680	ACP-013

CAPACITORS

Symbol	Description	Part No.
C1	Ceramic 0.01 50V	CKDYF 103Z 50
C2	Ceramic 0.047 25V	CKDBC 473Z 25
C3	Ceramic 0.01 50V	CKDYB 103K 50
C4	Ceramic 0.01 50V	CKDYB 103K 50
C5	Ceramic 0.01 50V	CKDYF 103Z 50
C6	Ceramic 0.01 50V	CKDYF 103Z 50
C7	Ceramic 0.01 50V	CKDYB 103K 50

Symbol	Description			Part No.
C8	Ceramic	0.047	25V	CKDBC 473Z 25
C9	Ceramic	0.047	25V	CKDBC 473Z 25
C10	Ceramic	33p	50V	CCDSL 330K 50
C11	Ceramic	0.01	50V	CKDYB 103K 50
C12	Ceramic	0.01	50V	CKDYF 103Z 50
C13	Ceramic	0.047	25V	CKDBC 473Z 25
C14	Ceramic	0.01	50V	CKDYF 103Z 50
C15	Ceramic	0.01	50V	CKDYF 103Z 50
C16	Ceramic	0.01	50V	CKDYF 103Z 50
C17	Ceramic	150p	50V	CCDSL 151K 50
C18	Ceramic	0.047	25V	CKDBC 473Z 25
C19	Ceramic	0.047	25V	CKDBC 473Z 25
C20	Ceramic	0.01	50V	CKDYB 103K 50
C21	Electrolytic	1	50V	CEA 010P 50
C22	Ceramic	0.047	25V	CKDBC 473Z 25
C23	Ceramic	0.047	25V	CKDBC 473Z 25
C24	Ceramic	0.047	25V	CKDBC 473Z 25
C25	Ceramic	0.047	25V	CKDBC 473Z 25
C26	Ceramic	0.01	50V	CKDYF 103Z 50
C27	Electrolytic	470	16V	CEA 471P 16
C28	Electrolytic	100	16V	CEA 101P 16
C29	Ceramic	100p	50V	CCDSL 101K 50
C30	Electrolytic	10	16V	CSZA 100M 16
C31	Electrolytic	100	16V	CEA 101P 16
C32	Electrolytic	10	16V	CSZA 100M 16
C33	Electrolytic	10	16V	CEANL 100P 16
C34	Mylar	0.047	50V	CQMA 473K 50
C35	Polystyrene	510p	50V	CQSH 511J 50
C36	Electrolytic	0.33	35V	CSZA R33M 35
C37	Electrolytic	3.3	16V	CSZA 3R3M 16
C38	Electrolytic	1	25V	CSZA 010M 25
C39	Electrolytic	1	50V	CEA 010P 50
C40	Electrolytic	10	16V	CSZA 100M 16
C41	Electrolytic	10	16V	CSZA 100M 16
C42	Electrolytic	4.7	25V	CEANL 4R7P 25
C43	Ceramic	0.047	25V	CKDBC 473Z 25
C44	Electrolytic	10	16V	CSZA 100M 16
C45	Electrolytic	47	10V	CEA 470P 10
C46	Ceramic	3p	50V	CCDSL 030C 50
C47	Polystyrene	820p	50V	CQSA 821G 50
C48	Electrolytic	0.56	35V	CSZA R56K 35
C49	Electrolytic	47	10V	CEA 470P 10
C50	Ceramic	180p	50V	CCDSL 181K 50
C51	Electrolytic	33	16V	ACH-321
C52	Ceramic	180p	50V	CCDSL 181K 50
C53	Ceramic	0.047	25V	CKDBC 473Z 25
C54	Electrolytic	220	16V	CEA 221P 16
C55	Polystyrene	820p	50V	CQSA 821G 50
C56	Electrolytic	0.56	35V	CSZA R56K 35
C57	Electrolytic	10	16V	CSZA 100M 16
C58	Electrolytic	3.3	50V	CEA 3R3P 50

Symbol	Description			Part No.
C59	Electrolytic	4.7	25V	CEANL 4R7P 25
C60	Polystyrene	1650p		ACE-012
C61	Mylar	0.01	50V	CQMA 103J 50
C62	Electrolytic	100	16V	CEA 101P 16
C63	Mylar	0.022	50V	CQMA 223J 50
C64	Mylar	0.01	50V	CQMA 103K 50
C65	Electrolytic	3.3	50V	CEA 3R3P 50
C66	Electrolytic	220	6V	CEA 221P 6
C67	Electrolytic	10	16V	CEA 100P 16
C68	Electrolytic	10	16V	CEA 100P 16
C69	Ceramic	0.01	50V	CKDYF 103Z 50
C70	Ceramic	0.01	50V	CKDYF 103Z 50
C71	Ceramic	0.047	25V	CKDBC 473Z 25
C72	Ceramic	1200p	50V	CKDYB 122K 50
C73	Electrolytic	4.7	35V	CEA 4R7P 35
C74	Ceramic	0.04	50V	CKDYF 403Z 50
C75	Ceramic	0.001	50V	CKDYB 102K 50
C76	Ceramic	0.01	50V	CKDYF 103Z 50
C77	Ceramic	0.01	50V	CKDYF 103Z 50
C78	Polystyrene	450p	50V	CQSA 451J 50
C79	Ceramic	10p	50V	CCDWK 100F 50
C80	Electrolytic	47	16V	CEA 470P 16
C81	Electrolytic	1	25V	CSZA 010M 25
C82	Electrolytic	0.47	50V	CEA R47P 50
C83	Ceramic	470p	50V	CKDYB 471K 50
C84	Mylar	0.0039	50V	CQMA 392J 50
C85	Mylar	0.0039	50V	CQMA 392J 50
C86	Electrolytic	10	16V	CEA 100P 16
C87	Electrolytic	0.1	35V	CSZA 0R1M 35
C88	Electrolytic	2.2	50V	CEA 2R2P 50
C89	Electrolytic	1	50V	CEA 010P 50
C90	Polystyrene	1650p		ACE-012
C91	Electrolytic	470	16V	CEA 471P 16
C92	Ceramic	820p	50V	CKDYB 821K 50
C93	Ceramic	820p	50V	CKDYB 821K 50
C94	Ceramic	100p	50V	CCDSL 101K 50

OTHERS

Symbol	Description	Part No.
	Nut	ABN-027
	Nut	ABN-026
	Screw	ABA-078
	Screw 3x6	ABA-116

* The IC used at Q_5 is either PA3001, or PA3001Y, depending on the model. These two ICs are not interchangeable without a minor alteration to the circuitry. When servicing, follow the instructions described below.

Replacing PA3001 with PA3001Y

Disconnect the jumper wire to the D_{10} section. Then insert a diode (1S2076), but be careful that the direction is correct.

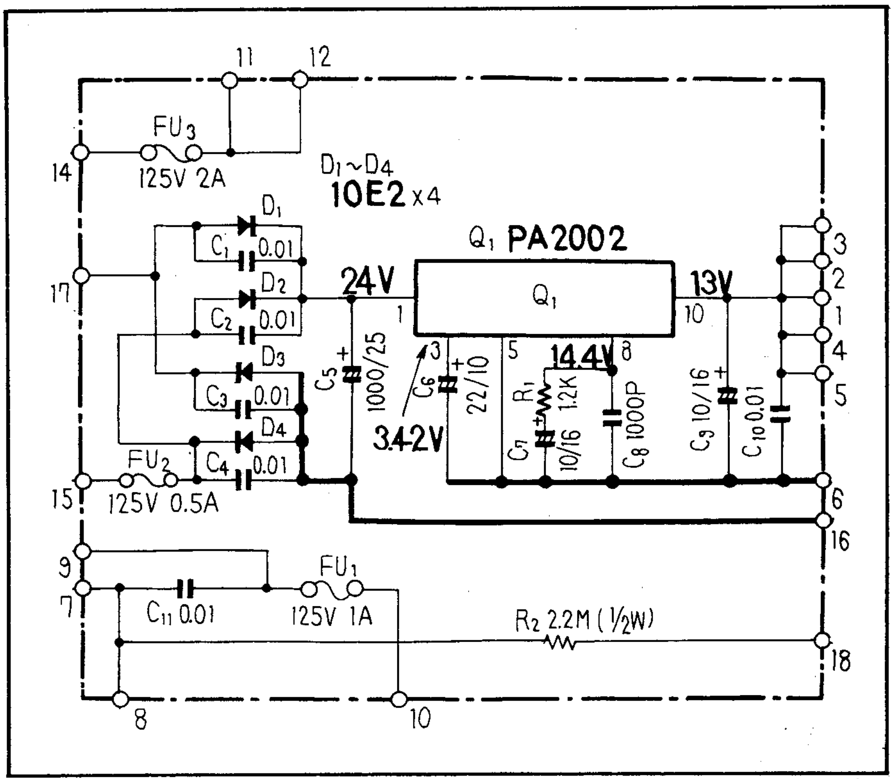
Replacing PA3001Y with PA3001

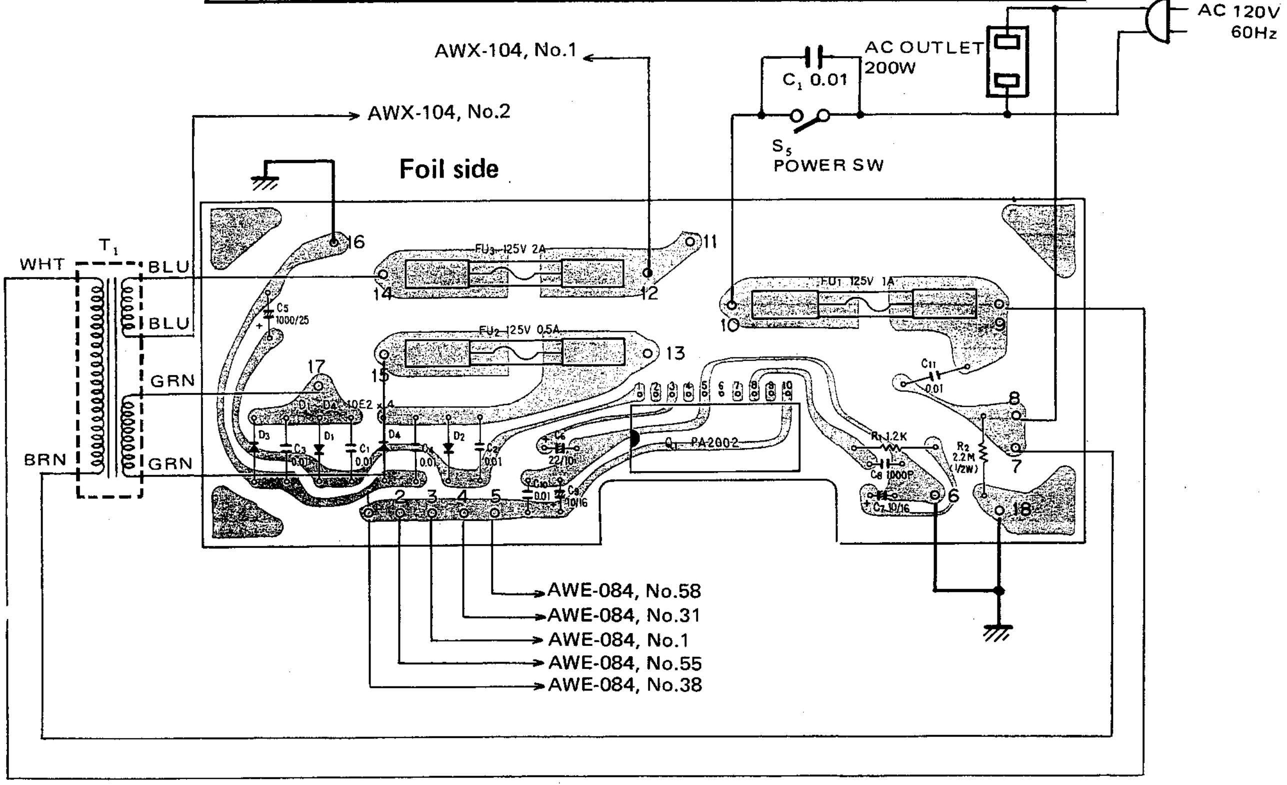
Remove diode D_{10} (1S2076), and connect the gap with a jumper wire.

How to tell PA3001 and PA3001Y apart

PA3001: the characters (PA3001) on the upper surface of the IC are "white".
PA3001Y: either the characters (PA3001) on the upper surface of the IC are "yellow", or the characters PA3001Y have been printed on.

12.4 POWER SUPPLY ASSEMBLY (AWR-119)


11
12
14
FU3
125V 2A
D1~D4
10E2 x4
D1
C1 0.01
D2
C2 0.01
D3
C3 0.01
D4
C4 0.01
17
FU2
125V 0.5A
15
Q1 PA2002
Q1
24V
13V
14.4V
3.42V
1
10
3
5
8
C5 1000/25
C6 22/10
R1 1.2K
C7 10/16
C8 1000P
C9 10/16
C10 0.01
3
2
1
4
5
6
16
9
7
C11 0.01
FU1
125V 1A
R2 2.2M (½W)
18
8
10


AC 120V 60Hz
AC OUTLET 200W
C1 0.01
S5 POWER SW
AWX-104, No.1
AWX-104, No.2
Foil side
T1
WHT
BLU
BLU
GRN
BRN
GRN
16
14
FU3 125V 2A
12
11
FU1 125V 1A
10
9
FU2 125V 0.5A
15
13
17
D1~D4 10E2 x4
C5 1000/25
D3
C3
D1
C1
D4
C4
D2
C2
C6 22/10
Q1 PA2002
C11 0.01
R1 1.2K
C8 1000P
C7 10/16
R2 2.2M (1/2W)
8
7
6
18
1
2
3
4
5
AWE-084, No.58
AWE-084, No.31
AWE-084, No.1
AWE-084, No.55
AWE-084, No.38

Parts List of Power Supply Assembly (AWR-119)

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	IC	PA2002
D1	Diode	10E2 (S1B01-02)
D2	Diode	10E2 (S1B01-02)
D3	Diode	10E2 (S1B01-02)
D4	Diode	10E2 (S1B01-02)

RESISTORS

Symbol	Description		Part No.
R1	Carbon film	1.2k	RD¼PS 122J
R2	Carbon film	2.2M	RD¼PS 225J

CAPACITORS

Symbol	Description			Part No.
C1	Ceramic	0.01	150V	ACG-004
C2	Ceramic	0.01	150V	ACG-004
C3	Ceramic	0.01	150V	ACG-004
C4	Ceramic	0.01	150V	ACG-004
C5	Electrolytic	1000	25V	CEA 102P 25
C6	Electrolytic	22	10V	CEA 220P 10
C7	Electrolytic	10	16V	CEA 100P 16
C8	Ceramic	0.001	50V	CKDYB 102K 50
C9	Electrolytic	10	16V	CEA 100P 16
C10	Ceramic	0.01	50V	CKDYB 103K 50
C11	Ceramic	0.01	125V	ACG-003

OTHERS

Symbol	Description	Part No.
	Fuse clip	AKR-013
	Fuse clip	AKR-030

AM/FM STEREO TUNER

TX-8500II

KC, S, HG

Additional

Service Manual

NOTES:

- This leaflet provides the description of the parts applies only to the TX-8500II/KC, S and HG types. For detailed please refer to the service manual of TX-8500II/KU type (p.5~p.44).
- The specifications for "KC", "S" and "HG" types are same as KU type except for following sections.

  Power Requirements:

  KC type .... Same as KU type
  HG type .... 220V and 240V (Switchable), 50Hz
  S type .... 110V, 120V, 220V and 240V (Switchable), 50/60Hz

1. CONTRAST OF MISCELLANEOUS PARTS

P.C. BOARD ASSEMBLIES

Symbol	Description	Part No.			Remarks
		KU, KC types	S type	HG type	
	Tuner assembly	AWE-084	AWE-085	AWE-069 ✓	
	Power supply assembly	AWR-119 (KU) AWR-135 (KC)	AWR-132	AWR-133 ✓	
	Switch assembly	....	AWX-113	....	

TRANSFORMER

Symbol	Description	Part No.			Remarks
		KU, KC types	S type	HG type	
T1	Power transformer	ATT-342 (KU) ATT-343 (KC)	ATT-345	ATT-344 ✓	

FUSES

Symbol	Description	Part No.			Remarks
		KU, KC types	S type	HG type	
FU1	Fuse 1A (Primary)	AEK-106	....	....	
	Fuse 500mA (Primary)	....	AEK-107	....	
	Fuse 500mA (Primary)	....	....	AEK-401	
FU2	Fuse 500mA (Secondary)	AEK-107	....	....	
	Fuse 500mA (Secondary)	....	....	AEK-401	
FU3	Fuse 2A (Secondary)	AEK-103	....	AEK-017	

SWITCHES

Symbol	Description	Part No.			Remarks
		KU, KC types	S type	HG type	
S5	Lever switch (POWER)	ASK-124	ASK-128	ASK-127 ✓	
S6	Slide switch (DE-EMPHASIS)	ASH-016	ASH-017	....	
S7	Plug in selector (Line voltage selector)	....	AKR-031	....	4 positions
		....	....	AKX-037 ✓	2 positions

CAPACITORS

Symbol	Description	Part No.			Remarks
		KU, KC types	S type	HG type	
C1	Ceramic 0.01 250V	ACG-001 (KU)	ACG-001	....	
	Ceramic 0.01 125V	ACG-014 (KC)			

OTHERS

Symbol	Description	Part No.			Remarks
		KU, KC types	S type	HG type	
	Terminal (ANTENNA)	AKA-002	AKA-002	AKA-007 ✓	
	AC socket (OUTLET)	AKP-002	AKP-002	....	
	AC socket (INLET)	....	....	AKP-008 ✓	
	AC power cord	ADG-005	ADG-016	....	
	Packing case	AHD-436 (KU) AHD-437 (KC)	AHD-436	AHD-438 ✓	
	Vinyl pouch	AHG-023	AHG-023	....	
	Operating instructions (English)	ARB-204	ARB-213	ARB-212	
	Operating instructions (Germany/French)	....	....	ARD-104 ✓	
	Accessory fuse 1A	....	AEK-106	....	
	Accessory fuse 500mA	....	AEK-107	....	
	Vinyl pouch	....	E11-033	....	

2. KC TYPE

2.1 SCHEMATIC DIAGRAM AND MISCELLANEOUS PARTS LIST

NOTE:

- *Capacitors: in µF unless otherwise noted p:pF*
- *Resistors: in Ω, ¼W unless otherwise noted k:kΩ, M:MΩ*

Miscellaneous Parts List

SWITCHES

Symbol	Description	Part No.
S5	Lever switch (POWER)	ASK-124
S6	Slide switch (DE-EMPHASIS)	ASH-016

TRANSFORMERS AND COIL

Symbol	Description	Part No.
T1	Power transformer	ATT-343
T2	Bar antenna	ATB-506
T3	Ferrite balun	T22-025
L1	RF choke coil	T24-030

LAMPS

Symbol	Description	Part No.
PL1	Lamp with wire 8V, 50mA	AEL-072
PL2	Lamp with wire 6V, 30mA	AEL-080
PL3	Lamp with wire 6V, 30mA	AEL-079
PL4	Lamp with wire 6V, 30mA	AEL-079
PL5	Lamp (Wedge type) 8V, 300mA	AEL-029
PL6	Lamp (Wedge type) 8V, 300mA	AEL-029
PL7	Lamp (Wedge type) 8V, 300mA	AEL-029
PL8	Lamp (Wedge type) 8V, 300mA	AEL-029

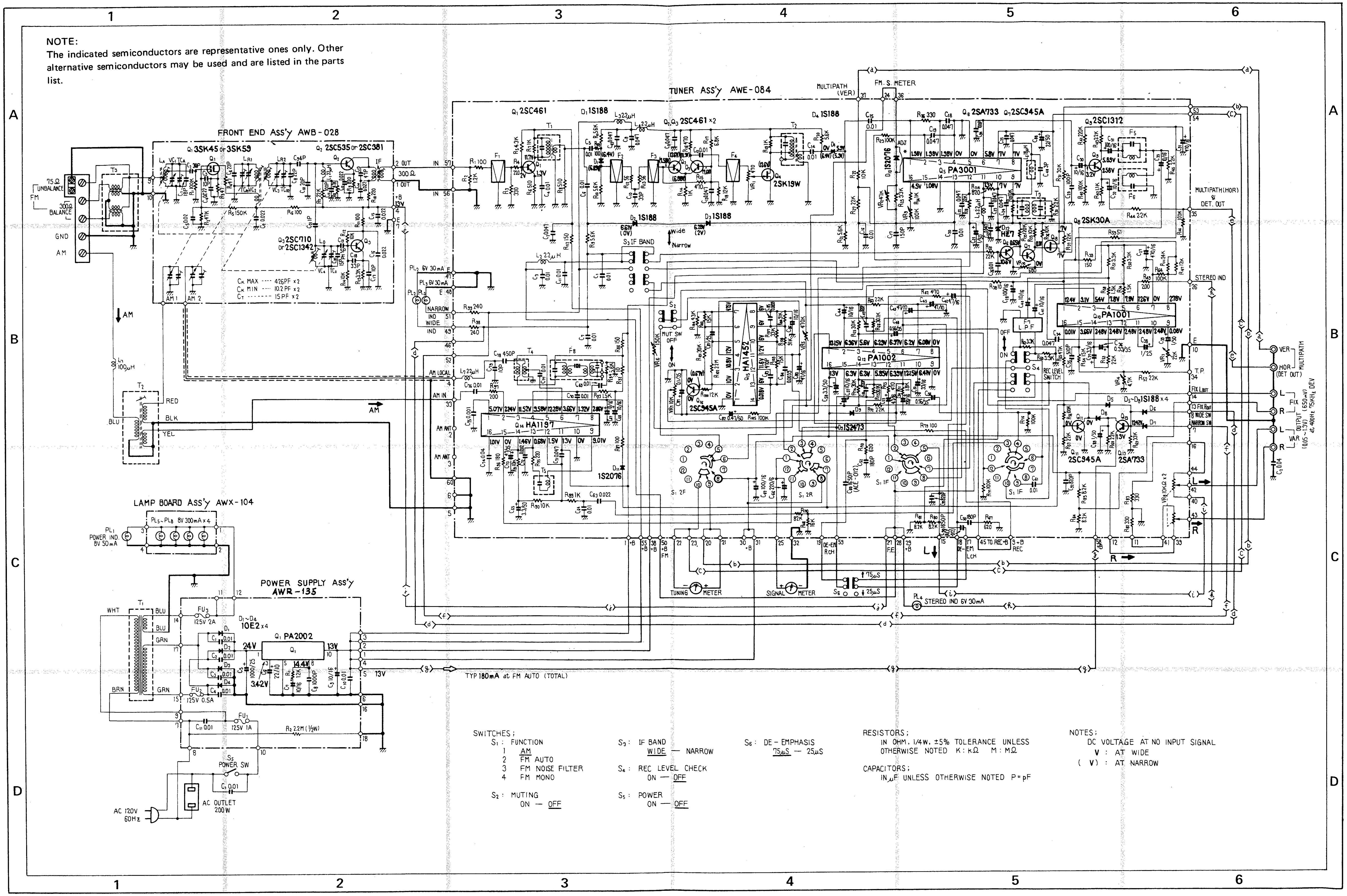
FUSES

Symbol	Description	Part No.
FU1	Fuse 1A (Primary)	AEK-106
FU2	Fuse 500mA (Secondary)	AEK-107
FU3	Fuse 2A (Secondary)	AEK-103

CAPACITORS

Symbol	Description			Part No.
C1	Ceramic	0.01	125V	ACG-014
C2	Ceramic	0.04	50V	CKDYF 403Z 50

NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.


1
2
3
4
5
6
A
B
C
D
TUNER ASS'y AWE-084
FRONT END ASS'y AWB-028
Q1 3SK45 or 3SK59
Q2 2SC535 or 2SC381
Q3 2SC710 or 2SC1342
CK MAX ---- 426PF x 2
CK MIN ---- 10.2 PF x 2
CT ---- 15PF x 2
75Ω UNBALANCE
300Ω BALANCE
FM
GND
AM
Q1 2SC461
D1 1S188
Q2,Q3 2SC461 x2
D4 1S188
Q4 2SK19W
Q5 PA3001
Q6 2SA733
Q7 2SC945A
Q8 2SK30A
Q9 2SC1312
Q10 PA1001
Q11 2SC945A
Q12 PA1002
Q13 2SA733
Q14 HA1197
Q15 HA1452
Q16 2SC945A
D10 1S2076
D12 HZ7
D2 1S188
D3 1S188
D5~D8 1S188 x4
D13 1S2473
S3 IF BAND
Wide
Narrow
MULTIPATH (VER)
FM S METER
MULTIPATH (HOR) & DET. OUT
STEREO IND
T.P
FIX Lout
FIX Rout
WIDE SW
NARROW SW
VER
HOR (DET OUT)
MULTIPATH
FIX
OUTPUT (650mV) at 400Hz 75kHz DEV
VAR (0.05~1.3V)
L.P.F
REC LEVEL SWITCH
MUT SW OFF ON
AM LOCAL
AM IN
AM ANT
NARROW
IND
WIDE
PL2 6V 30mA
PL3 6V 30mA
L1 100μH
T2
RED
BLK
YEL
BLU
AM 1
AM 2
LAMP BOARD ASS'y AWX-104
PL5~PL8 8V 300mA x 4
PL1 POWER IND. 8V 50mA
POWER SUPPLY ASS'y AWR-135
Q1 PA2002
D1~D4 10E2 x4
FU3 125V 2A
FU2 125V 0.5A
FU1 125V 1A
R2 2.2M (1/2W)
C11 0.01
S5 POWER SW
C1 0.01
AC OUTLET 200W
AC 120V 60Hz
WHT
BLU
GRN
BRN
24V
13V
14.4V
3.42V
S1 2F
S1 2R
S1 1F
TUNING METER
SIGNAL METER
S6
75μS
25μS
PL4 STEREO IND 6V 30mA
DE-EM RCH
DE-EM LCH
45 TO REC+B
F.E
+B FM
+B REC
L
R
TYP 180mA at FM AUTO (TOTAL)

SWITCHES;
S₁: FUNCTION
1 AM
2 FM AUTO
3 FM NOISE FILTER
4 FM MONO

S₂: MUTING
ON — OFF

S₃: IF BAND
WIDE — NARROW

S₄: REC LEVEL CHECK
ON — OFF

S₅: POWER
ON — OFF

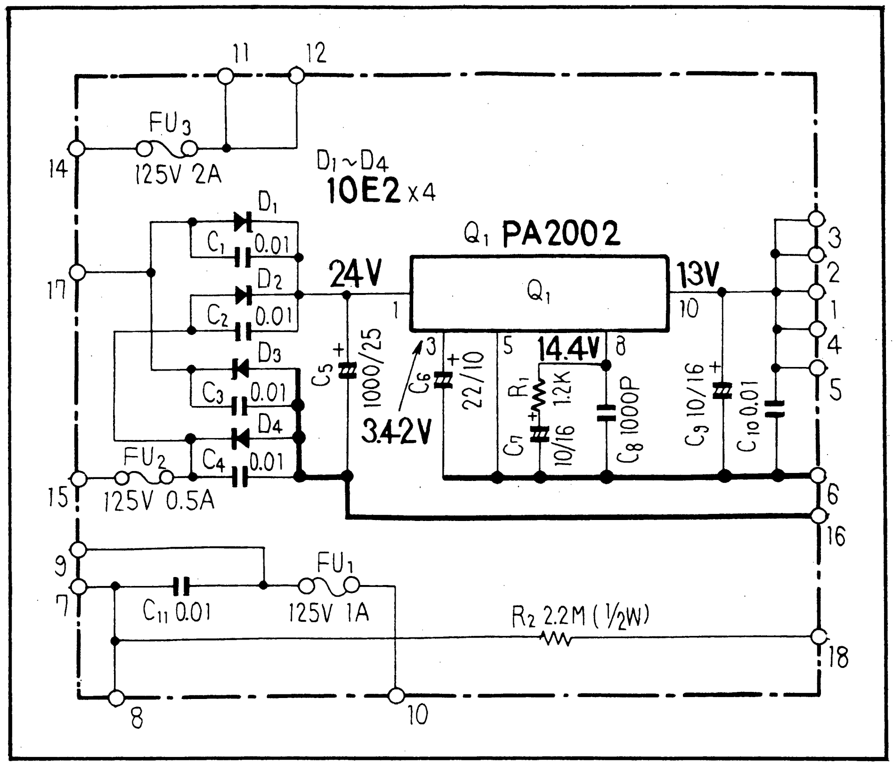
S₆: DE-EMPHASIS
75μS — 25μS

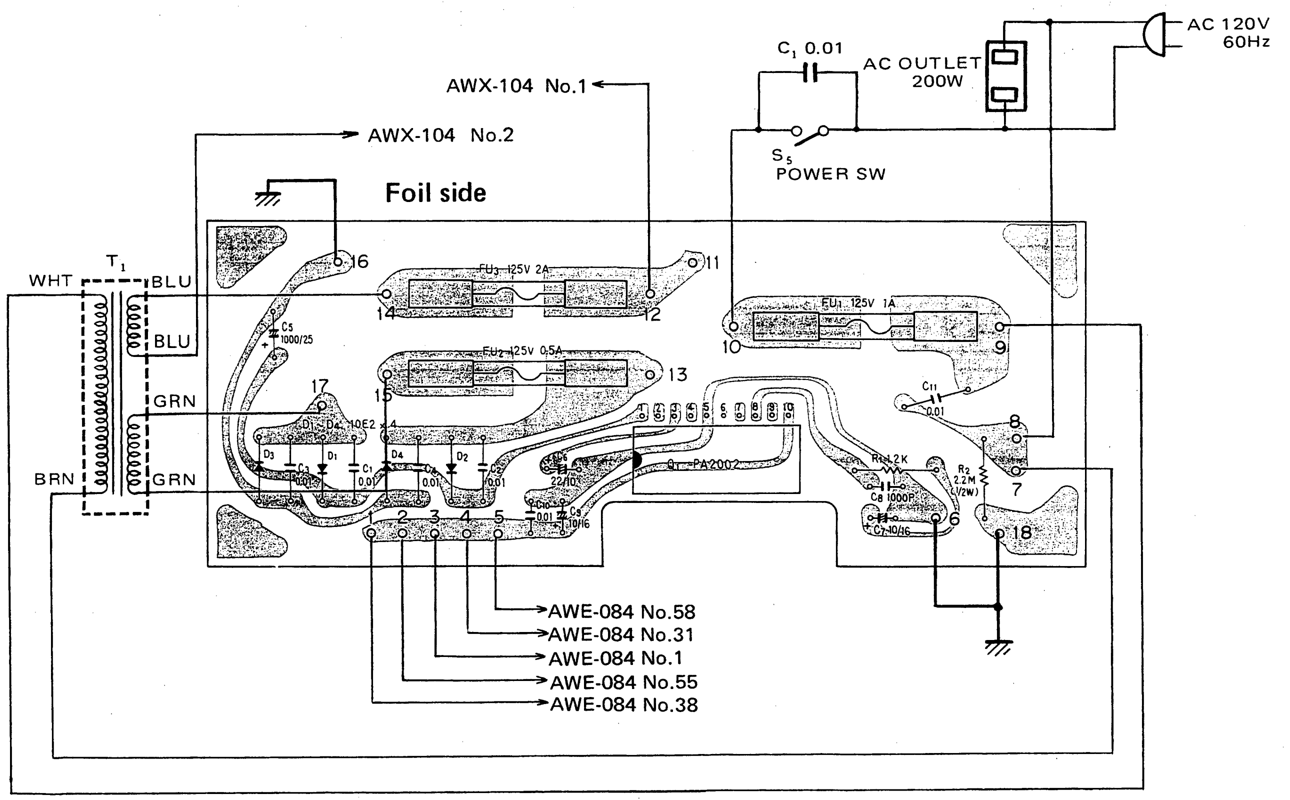
RESISTORS;
IN OHM, 1/4W, ±5% TOLERANCE UNLESS OTHERWISE NOTED K: kΩ M: MΩ

CAPACITORS;
IN μF UNLESS OTHERWISE NOTED P = pF

NOTES;
DC VOLTAGE AT NO INPUT SIGNAL
V : AT WIDE
(V) : AT NARROW

2.2 POWER SUPPLY ASSEMBLY (AWR-135)


11
12
FU3
125V 2A
14
D1~D4
10E2 x4
D1
C1 0.01
D2
C2 0.01
D3
C3 0.01
D4
C4 0.01
17
Q1 PA2002
24V
13V
Q1
1
10
3
5
8
14.4V
C5 1000/25
C6 22/10
3.42V
R1 1.2K
C7 10/16
C8 1000P
C9 10/16
C10 0.01
3
2
1
4
5
6
16
FU2
125V 0.5A
15
9
7
FU1
C11 0.01
125V 1A
R2 2.2M (1/2W)
18
8
10


AC 120V
60Hz
C1 0.01
AC OUTLET
200W
AWX-104 No.1
AWX-104 No.2
S5
POWER SW
Foil side
T1
WHT
BLU
BLU
GRN
BRN
GRN
16
FU3 125V 2A
14
12
11
FU1 125V 1A
10
9
FU2 125V 0.5A
13
17
15
D1~D4 10E2 x4
C5 1000/25
C11 0.01
Q1 PA2002
R1 1.2K
R2 2.2M (1/2W)
C8 1000P
C7 10/16
C6 22/10
C9 10/16
8
7
6
18
1
2
3
4
5
AWE-084 No.58
AWE-084 No.31
AWE-084 No.1
AWE-084 No.55
AWE-084 No.38

Parts List of Power Supply Assembly (AWR-135)

SEMICONDUCTOR

Symbol	Description	Part No.
Q1	IC	PA 2002
D1	Diode	10E2 (SIB01-02)
D2	Diode	10E2 (SIB01-02)
D3	Diode	10E2 (SIB01-02)
D4	Diode	10E2 (SIB01-02)

RESISTORS

Symbol	Description	Part No.
R1	Carbon film 1.2k	RD¼PS 122J
R2	Carbon film 2.2M	RD¼PS 225J

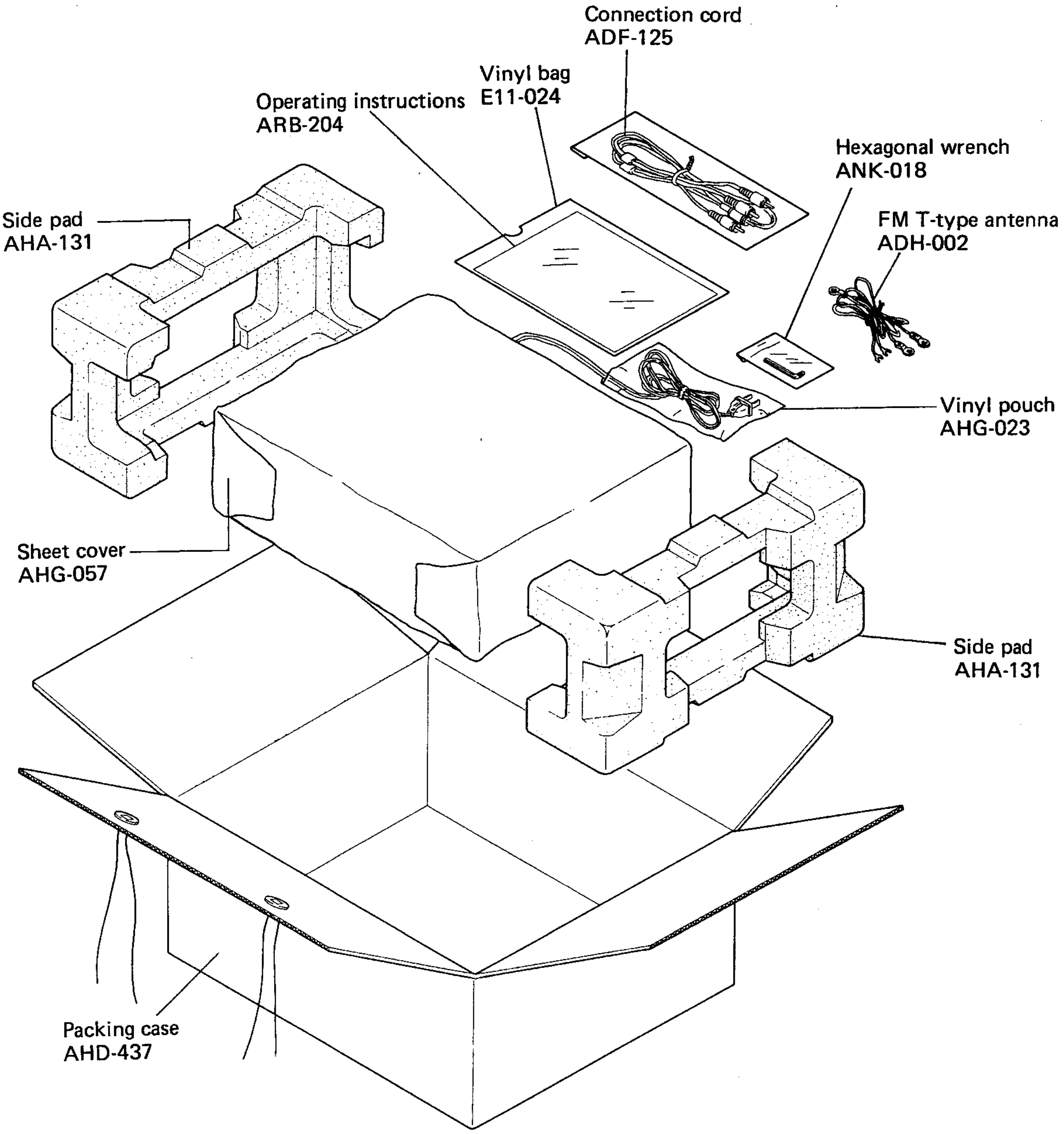
CAPACITORS

Symbol	Description	Part No.
C1	Ceramic 0.01 150V	ACG-004
C2	Ceramic 0.01 150V	ACG-004
C3	Ceramic 0.01 150V	ACG-004
C4	Ceramic 0.01 150V	ACG-004
C5	Electrolytic 1,000 25V	CEA 102P 25
C6	Electrolytic 22 25V	CEA 220P 25
C7	Electrolytic 10 16V	CEA 100P 16
C8	Ceramic 0.001 50V	CKDYB 102K 50
C9	Electrolytic 10 16V	CEA 100P 16
C10	Ceramic 0.01 50V	CKDYB 103K 50
C11	Ceramic 0.01 125V	ACG-014

OTHERS

Symbol	Description	Part No.
	Fuse clip	AKR-013
	Fuse clip	AKR-030

2.3 PACKING


Connection cord
ADF-125
Vinyl bag
E11-024
Operating instructions
ARB-204
Hexagonal wrench
ANK-018
FM T-type antenna
ADH-002
Side pad
AHA-131
Vinyl pouch
AHG-023
Sheet cover
AHG-057
Side pad
AHA-131
Packing case
AHD-437

3. HG TYPE

3.1 SCHEMATIC DIAGRAM AND MISCELLANEOUS PARTS LIST

NOTE:
- *Capacitors: in μF unless otherwise noted p:pF*
- *Resistors: in Ω, ¼W unless otherwise noted k:kΩ, M:MΩ*

Miscellaneous Parts List

SWITCHES

Symbol	Description	Part No.
S5	Lever switch (POWER)	ASK-127
S7	Plug in selector (Line voltage selector)	AKX-037

TRANSFORMERS AND COIL

Symbol	Description	Part No.
T1	Power transformer	ATT-344
T2	Bar antenna	ATB-506
T3	Ferrite balun	T22-025
L1	RF choke coil	T24-030

LAMPS

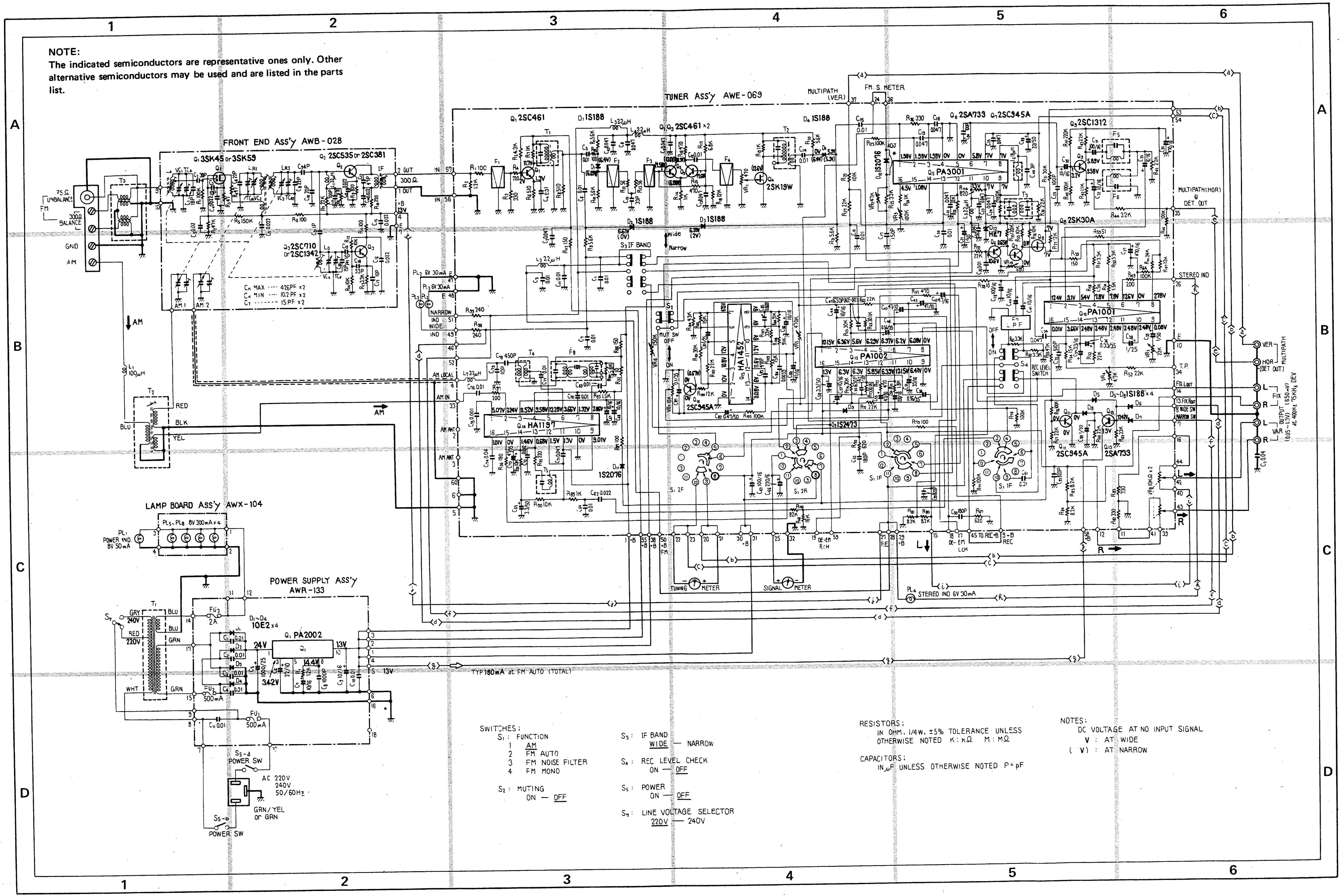
Symbol	Description	Part No.
PL1	Lamp with wire 8V, 50mA	AEL-072
PL2	Lamp with wire 6V, 30mA	AEL-080
PL3	Lamp with wire 6V, 30mA	AEL-079
PL4	Lamp with wire 6V, 30mA	AEL-079
PL5	Lamp (Wedge type) 8V, 300mA	AEL-029
PL6	Lamp (Wedge type) 8V, 300mA	AEL-029
PL7	Lamp (Wedge type) 8V, 300mA	AEL-029
PL8	Lamp (Wedge type) 8V, 300mA	AEL-029

FUSES

Symbol	Description	Part No.
FU1	Fuse 500mA (Primary)	AEK-401
FU2	Fuse 500mA (Secondary)	AEK-401
FU3	Fuse 2A (Secondary)	AEK-017

CAPACITOR

Symbol	Description	Part No.
C2	Ceramic 0.04 50V	CKDYF 403Z 50


FRONT END ASS'Y AWB-028
TUNER ASS'Y AWE-069
LAMP BOARD ASS'Y AWX-104
POWER SUPPLY ASS'Y AWR-133
Q1 3SK45 or 3SK59
Q2 2SC535 or 2SC381
Q3 2SC710 or 2SC1342
Q1 2SC461
D1 1S188
Q2 Q3 2SC461 ×2
D4 1S188
Q4 2SK19W
Q6 2SA733
Q7 2SC945A
Q9 2SC1312
Q5 PA3001
Q8 2SK30A
Q10 PA1001
Q12 PA1002
Q15 HA1457
Q14 HA1197
Q16 2SC945A
Q11 2SC945A
Q13 2SA733
D5~D8 1S188 ×4
D11 1S2076
D3 1S2473
Q1 PA2002
D1~D4 10E2 ×4
75Ω UNBALANCE
300Ω BALANCE
FM
GND
AM
MULTIPATH (VER)
FM S METER
MULTIPATH (HOR) DET OUT
STEREO IND
S3 IF BAND
Wide
Narrow
S4 REC LEVEL SWITCH
L.P.F
VER
HOR (DET OUT)
MULTIPATH
FIX
VAR
OUTPUT (650mV) (0.05~1.3V) at 400Hz 75kHz DEV
TUNING METER
SIGNAL METER
PL4 STEREO IND 6V 30mA
PL1 POWER IND 8V 50mA
PL5~PL8 8V 300mA ×4
PL2 6V 30mA
PL3 6V 30mA
S1 2F
S1 2R
S1 1F
S7
240V
220V
FU3 2A
FU2 500mA
FU1 500mA
S5-a POWER SW
S5-b POWER SW
AC 220V 240V 50/60Hz
GRN/YEL or GRN
TYP 180mA at FM AUTO (TOTAL)
Cx MAX ---- 426PF ×2
Cx MIN ---- 10.2PF ×2
C1 ------- 15PF ×2
1 2 3 4 5 6
A B C D

NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.

SWITCHES;
S1 : FUNCTION
1 AM
2 FM AUTO
3 FM NOISE FILTER
4 FM MONO

S2 : MUTING
ON — OFF

S3 : IF BAND
WIDE — NARROW

S4 : REC LEVEL CHECK
ON — OFF

S5 : POWER
ON — OFF

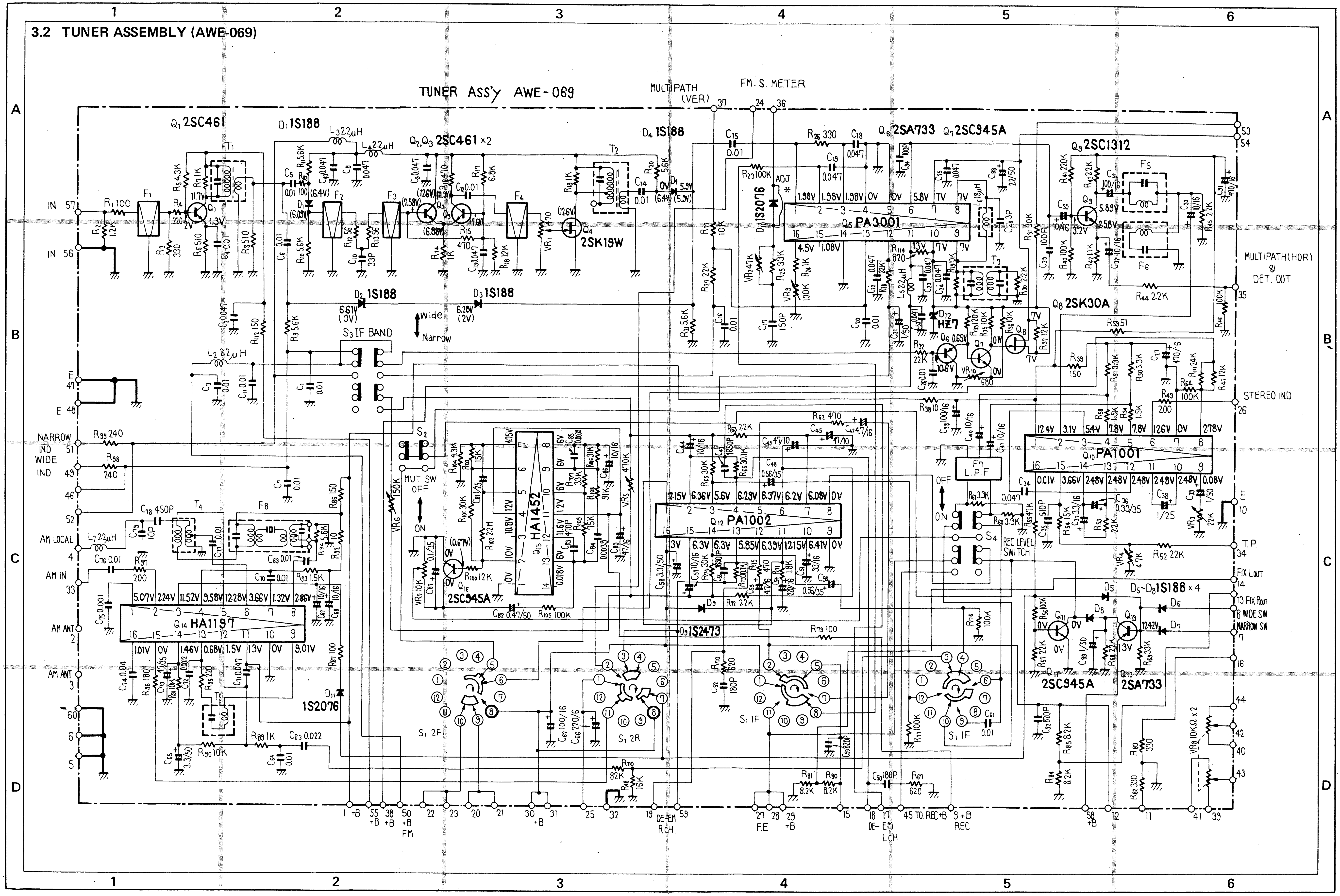
S7 : LINE VOLTAGE SELECTOR
220V — 240V

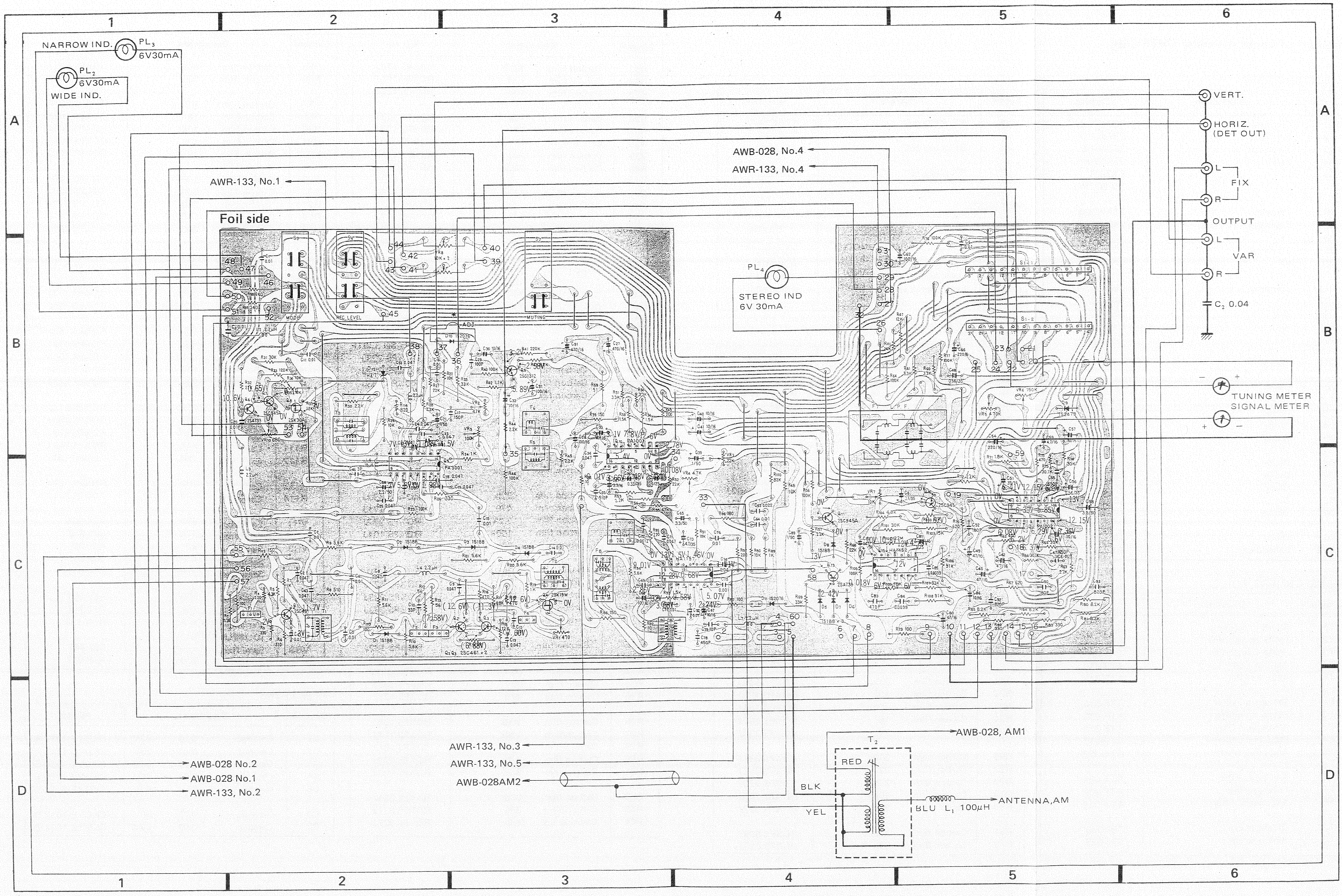
RESISTORS;
IN OHM, 1/4W, ±5% TOLERANCE UNLESS OTHERWISE NOTED K : kΩ M : MΩ

CAPACITORS;
IN μF UNLESS OTHERWISE NOTED P = pF

NOTES;
DC VOLTAGE AT NO INPUT SIGNAL
V : AT WIDE
(V) : AT NARROW

3.2 TUNER ASSEMBLY (AWE-069)


TUNER ASS'y AWE-069
MULTIPATH (VER)
FM. S. METER
Q1 2SC461
D1 1S188
Q2, Q3 2SC461 ×2
D4 1S188
Q4 2SK19W
Q6 2SA733 Q7 2SC945A
Q5 PA3001
Q9 2SC1312
Q8 2SK30A
D2 1S188
D3 1S188
D6 1S2076
D12 HZ7
S3 IF BAND
Wide
Narrow
S2
MUT SW OFF
ON
Q15 HA1452
Q16 2SC945A
Q12 PA1002
Q10 PA1001
F7 L.P.F
S4
REC LEVEL SWITCH
Q14 HA1197
D11 1S2076
D9 1S2473
D5~D8 1S188 ×4
Q11 2SC945A
Q13 2SA733
S1 2F
S1 2R
S1 1F
S1 1F
VR8 10KΩ ×2
IN 57
IN 56
E 47
E 48
NARROW IND 51
WIDE IND 49
46
52
AM LOCAL 4
AM IN 33
AM ANT 2
AM ANT 3
60
6
5
MULTIPATH (HOR) & DET. OUT 35
STEREO IND 26
E 10
T.P. 34
FIX Lout 14
13 FIX Rout
8 WIDE SW
NARROW SW 7
16
44
42
40
43
1 +B
55 +B
38 +B
50 +B FM
22
23
20
21
30 +B
31
25
32
19 DE-EM RCH
59
27 F.E
28
29 +B
15
18 DE-EM LCH
17
45 TO. REC+B
9 +B REC
58 +B
12
11
41
39
53
54
37
24
36
1
2
3
4
5
6
A
B
C
D


NARROW IND.
PL₃
6V30mA
PL₂
6V30mA
WIDE IND.
AWR-133, No.1
Foil side
MODE
REC LEVEL
MUTING
AWB-028, No.4
AWR-133, No.4
PL₄
STEREO IND
6V 30mA
VERT.
HORIZ.
(DET OUT)
L
R
FIX
OUTPUT
L
R
VAR
C₂ 0.04
TUNING METER
SIGNAL METER
AWB-028, AM1
T₂
RED
BLK
YEL
BLU L₁ 100μH
ANTENNA,AM
AWR-133, No.3
AWR-133, No.5
AWB-028AM2
AWB-028 No.2
AWB-028 No.1
AWR-133, No.2
1
2
3
4
5
6
A
B
C
D

Parts List of Tuner Assembly (AWE-069)

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	Transistor	2SC461-B
Q2	Transistor	2SC461-B
Q3	Transistor	2SC461-B
Q4	FET	2SK19-W
* Q5	IC	PA3001 (PA3001Y)
Q6	Transistor	2SA733-Q
Q7	Transistor	2SC945A-Q
Q8	FET	2SK30A-Y
Q9	Transistor	2SC1312-G
Q10	IC	PA1001
Q11	Transistor	2SC945A-Q
Q12	IC	PA1002
Q13	Transistor	2SA733-Q
Q14	IC	HA1197
Q15	IC	HA1452W
Q16	Transistor	2SC945A-Q
D1	Diode	1S188FM-1
D2	Diode	1S188FM-1
D3	Diode	1S188FM-1
D4	Diode	1S188FM-1
D5	Diode	1S188FM-1
D6	Diode	1S188FM-1
D7	Diode	1S188FM-1
D8	Diode	1S188FM-1
D9	Diode	1S2473
* D10	Diode	1S2076
D11	Diode	1S2076
D12	Zener diode	HZ7-B

TRANSFORMERS, COILS

Symbol	Description	Part No.
T1	FM IF transformer	ATE-023
T2	FM IF transformer	ATE-024
T3	FM IF transformer	T73-035
T4	AM OSC coil	ATB-019
T5	455k Hz filter	ATF-013
F1	FM ceramic filter	ATF-013
F2	FM ceramic filter	ATF-013
F3	FM ceramic filter	ATF-013
F4	FM ceramic filter	ATF-013
F5	Anti-birdy filter	ATF-023
F6	Anti-birdy filter	ATF-024
F7	Low pass filter	ATF-036
F8	AM ceramic filter	ATF-034
L2	RF choke coil	T24-028
L3	RF choke coil	T24-028
L4	RF choke coil	T24-028
L5	RF choke coil	T24-028
L6	RF choke coil	ATH-007
L7	RF choke coil	T24-028

SWITCHES

Symbol	Description	Part No.
S1	Rotary switch (FUNCTION)	ASD-063
S2	Lever switch (FM MUTING)	ASK-109
S3	Lever switch (IF BAND)	ASK-112
S4	Lever switch (REC LEVEL CHECK)	ASK-112

RESISTORS

Symbol	Description	Part No.
R1	Carbon film 100	RD¼PS 101J
R2	Carbon film 1.2k	RD¼PS 122J
R3	Carbon film 330	RD¼PS 331J
R4	Carbon film 220	RD¼PS 221J
R5	Carbon film 4.3k	RD¼PS 432J
R6	Carbon film 510	RD¼PS 511J
R7	Carbon film 1k	RD¼PS 102J
R8	Carbon film 510	RD¼PS 511J
R9	Carbon film 5.6k	RD¼PS 562J
R10	Carbon film 5.6k	RD¼PS 562J
R11	Carbon film 5.6k	RD¼PS 562J
R12	Carbon film 56	RD¼PS 560J
R13	Carbon film 56	RD¼PS 560J
R14	Carbon film 1k	RD¼PS 102J
R15	Carbon film 470	RD¼PS 471J
R16	Carbon film 470	RD¼PS 471J
R17	Carbon film 6.8k	RD¼PS 682J
R18	Carbon film 12k	RD¼PS 123J
R19	Carbon film 1k	RD¼PS 102J
R20	Carbon film 5.6k	RD¼PS 562J
R21	Carbon film 5.6k	RD¼PS 562J
R22	Carbon film 10k	RD¼PS 103J
R23	Carbon film 100k	RD¼PS 104J
R24	Carbon film 1k	RD¼PS 102J
R25	Carbon film 33k	RD¼PS 333J
R26	Carbon film 330	RD¼PS 331J
R27	Carbon film 22k	RD¼PS 223J
R28	Carbon film 2.2k	RD¼PS 222J
R29	Carbon film 10k	RD¼PS 103J
R30	Carbon film 2.2k	RD¼PS 222J
R31	Carbon film 30k	RD¼PS 303J
R32	Carbon film 22k	RD¼PS 223J
R33	Carbon film 120k	RD¼PS 124J
R34	Carbon film 1.5k	RD¼PS 152J
R35	Carbon film 10k	RD¼PS 103J
R36	Carbon film 10k	RD¼PS 103J
R37	Carbon film 12k	RD¼PS 123J
R38	Carbon film 10	RD¼PS 100J
R39	Carbon film 150	RD¼PS 151J
R40	Carbon film 100k	RD¼PS 104J
R41	Carbon film 220k	RD¼PS 224J
R42	Carbon film 1.1k	RD¼PS 112J
R43	Carbon film 2.2k	RD¼PS 222J
R44	Carbon film 2.2k	RD¼PS 222J
R45	Carbonf ilm 2.2k	RD¼PS 222J
R46	Carbon film 100k	RD¼PS 104J
R47	Carbon film 12k	RD¼PS 123J
R48	Carbon film 16k	RD¼PS 163J
R49	Carbon film 200	RD¼PS 201J
R50	Metal film 3.3k ⅕W	RN⅕SQ 3301F
R51	Metal film 3.3k ⅕W	RN⅕SQ 3301F
R52	Carbon film 22k	RD¼PS 223J
R53	Carbon film 2.2k	RD¼PS 222J
R54	Carbon film 15k	RD¼PS 153J
R55	Carbon film 47k	RD¼PS 473J
R56	Carbon film 100k	RD¼PS 104J
R57	Carbon film 22k	RD¼PS 223J
R58	Carbon film 1.5k	RD¼PS 152J
R59	Carbon film 51	RD¼PS 510J
R60	Carbon film 3.3k	RD¼PS 332J
R61	Carbon film 3.3k	RD¼PS 332J
R62	Carbon film 470	RD¼PS 471J
R63	Carbon film 2.2k	RD¼PS 222J
R64	Carbon film 100k	RD¼PS 104J
R65	Carbon film 30k	RD¼PS 303J
R66	Metal film 30.1k ⅕W	RN⅕SQ 3012F
R67	Carbon film 620	RD¼PS 621J
R68	Carbon film 22k	RD¼PS 223J
R69	Carbon film 33k	RD¼PS 333J
R70	Carbon film 620	RD¼PS 621J
R71	Carbon film 1.8k	RD¼PS 182J
R72	Carbon film 2.2k	RD¼PS 222J
R73	Metal film 30.1K ⅕W	RN⅕SQ 3012F
R74	Carbon film 30k	RD¼PS 303J
R75	Carbon film 470	RD¼PS 471J
R76	Carbon film 100k	RD¼PS 104J
R77	Carbon film 100k	RD¼PS 104J
R79	Carbon film 100	RD¼PS 101J
R80	Carbon film 8.2k	RD¼PS 822J
R81	Carbon film 8.2k	RD¼PS 822J
R82	Carbon film 330	RD¼PS 331J
R83	Carbon film 330	RD¼PS 331J
R84	Carbon film 8.2k	RD¼PS 822J
R85	Carbon film 8.2k	RD¼PS 822J
R86	Carbon film 150	RD¼PS 151J
R87	Carbon film 100	RD¼PS 101J
R89	Carbon film 1k	RD¼PS 102J
R90	Carbon film 10k	RD¼PS 103J
R91	Carbon film 10k	RD¼PS 103J
R92	Carbon film 10	RD¼PS 100J
R93	Carbon film 1.5k	RD¼PS 152J
R94	Carbon film 5.6k	RD¼PS 562J
R95	Carbon film 220	RD¼PS 221J
R96	Carbon film 180	RD¼PS 181J
R97	Carbon film 200	RD¼PS 201J
R98	Carbon film 240	RD¼PS 241J
R99	Carbon film 240	RD¼PS 241J
R100	Carbon film 12k	RD¼PS 123J
R101	Carbon film 30k	RD¼PS 303J
R102	Carbon film 2.2M	RD¼PS 225J
R103	Carbon film 15k	RD¼PS 153J
R104	Carbon film 4.3k	RD¼PS 432J
R105	Carbon film 100k	RD¼PS 104J
R106	Carbon film 91k	RD¼PS 913J
R107	Carbon film 33k	RD¼PS 333J
R108	Carbon film 91k	RD¼PS 913J
R109	Carbon film 75k	RD¼PS 753J
R110	Carbon film 82k	RD¼PS 823J
R111	Carbon film 24k	RD¼PS 243J
R112	Carbon film 150	RD¼PS 151J
R113	Carbon film 100	RD¼PS 101J
R114	Carbon film 820	RD¼PS 821J
VR1	Semi-fixed 470	ACP-006
VR2	Semi-fixed 47k	C92-048
VR3	Semi-fixed 22k	ACP-056
VR4	Semi-fixed 4.7k	C92-051
VR5	Semi-fixed 470k	ACP-011
VR6	Semi-fixed 150k	ACP-057
VR7	Semi-fixed 10k	C92-049
VR8	Variable resistor 10k (OUTPUT LEVEL)	ACV-178
VR9	Semi-fixed 100k	C92-047
VR10	Semi-fixed 680	ACP-013

CAPACITORS

Symbol	Description	Part No.
C1	Ceramic 0.01 50V	CKDYF 103Z 50
C2	Ceramic 0.047 25V	CKDBC 473Z 25
C3	Ceramic 0.01 50V	CKDYB 103K 50
C4	Ceramic 0.01 50V	CKDYB 103K 50
C5	Ceramic 0.01 50V	CKDYF 103Z 50
C6	Ceramic 0.01 50V	CKDYF 103Z 50
C7	Ceramic 0.01 50V	CKDYB 103K 50

Symbol	Description			Part No.
C8	Ceramic	0.047	25V	CKDBC 473Z 25
C9	Ceramic	0.047	25V	CKDBC 473Z 25
C10	Ceramic	33p	50V	CCDSL 330K 50
C11	Ceramic	0.01	50V	CKDYB 103K 50
C12	Ceramic	0.01	50V	CKDYF 103Z 50
C13	Ceramic	0.047	25V	CKDBC 473Z 25
C14	Ceramic	0.01	50V	CKDYF 103Z 50
C15	Ceramic	0.01	50V	CKDYF 103Z 50
C16	Ceramic	0.01	50V	CKDYF 103Z 50
C17	Ceramic	150p	50V	CCDSL 151K 50
C18	Ceramic	0.047	25V	CKDBC 473Z 25
C19	Ceramic	0.047	25V	CKDBC 473Z 25
C20	Ceramic	0.01	50V	CKDYB 103K 50
C21	Electrolytic	1	50V	CEA 010P 50
C22	Ceramic	0.047	25V	CKDBC 473Z 25
C23	Ceramic	0.047	25V	CKDBC 473Z 25
C24	Ceramic	0.047	25V	CKDBC 473Z 25
C25	Ceramic	0.047	25V	CKDBC 473Z 25
C26	Ceramic	0.01	50V	CKDYF 103Z 50
C27	Electrolytic	470	16V	CEA 471P 16
C28	Electrolytic	100	16V	CEA 101P 16
C29	Ceramic	100p	50V	CCDSL 101K 50
C30	Electrolytic	10	16V	CSZA 100M 16
C31	Electrolytic	100	16V	CEA 101P 16
C32	Electrolytic	10	16V	CSZA 100M 16
C33	Electrolytic	10	16V	CEANL 100P 16
C34	Mylar	0.047	50V	CQMA 473K 50
C35	Polystyrene	510p	50V	CQSH 511J 50
C36	Electrolytic	0.33	35V	CSZA R33M 35
C37	Electrolytic	3.3	16V	CSZA 3R3M 16
C38	Electrolytic	1	25V	CSZA 010M 25
C39	Electrolytic	1	50V	CEA 010P 50
C40	Electrolytic	10	16V	CSZA 100M 16
C41	Electrolytic	10	16V	CSZA 100M 16
C42	Electrolytic	4.7	25V	CEANL 4R7P 25
C43	Ceramic	0.047	25V	CKDBC 473Z 25
C44	Electrolytic	10	16V	CSZA 100M 16
C45	Electrolytic	47	10V	CEA 470P 10
C46	Ceramic	3p	50V	CCDSL 030C 50
C47	Polystyrene	1650P		ACE-012
C48	Electrolytic	0.56	35V	CSZA R56K 35
C49	Electrolytic	47	10V	CEA 470P 10
C50	Ceramic	180p	50V	CCDSL 181K 50
C51	Electrolytic	33	16V	ACH-321
C52	Ceramic	180p	50V	CCDSL 181K 50
C53	Ceramic	0.047	25V	CKDBC 473Z 25
C54	Electrolytic	220	16V	CEA 221P 16
C55	Polystyrene	1650p		ACE-012
C56	Electrolytic	0.56	35V	CSZA R56K 35
C57	Electrolytic	10	16V	CSZA 100M 16
C58	Electrolytic	3.3	50V	CEA 3R3P 50

Symbol	Description			Part No.
C59	Electrolytic	4.7	25V	CEANL 4R7P 25
C60	....			....
C61	Mylar	0.01	50V	CQMA 103J 50
C62	Electrolytic	100	16V	CEA 101P 16
C63	Mylar	0.022	50V	CQMA 223J 50
C64	Mylar	0.01	50V	CQMA 103K 50
C65	Electrolytic	3.3	50V	CEA 3R3P 50
C66	Electrolytic	220	6V	CEA 221P 6
C67	Electrolytic	10	16V	CEA 100P 16
C68	Electrolytic	10	16V	CEA 100P 16
C69	Ceramic	0.01	50V	CKDYF 103Z 50
C70	Ceramic	0.01	50V	CKDYF 103Z 50
C71	Ceramic	0.047	25V	CKDBC 473Z 25
C72	Ceramic	1200p	50V	CKDYB 122K 50
C73	Electrolytic	4.7	35V	CEA 4R7P 35
C74	Ceramic	0.04	50V	CKDYF 403Z 50
C75	Ceramic	0.001	50V	CKDYB 102K 50
C76	Ceramic	0.01	50V	CKDYF 103Z 50
C77	Ceramic	0.01	50V	CKDYF 103Z 50
C78	Polystyrene	450p	50V	CQSA 451J 50
C79	Ceramic	10p	50V	CCDWK 100F 50
C80	Electrolytic	47	16V	CEA 470P 16
C81	Electrolytic	1	25V	CSZA 010M 25
C82	Electrolytic	0.47	50V	CEA R47P 50
C83	Ceramic	470p	50V	CKDYB 471K 50
C84	Mylar	0.0039	50V	CQMA 392J 50
C85	Mylar	0.0039	50V	CQMA 392J 50
C86	Electrolytic	10	16V	CEA 100P 16
C87	Electrolytic	0.1	35V	CSZA 0R1M 35
C88	Electrolytic	2.2	50V	CEA 2R2P 50
C89	Electrolytic	1	50V	CEA 010P 50
C90	....			....
C91	Electrolytic	470	16V	CEA 471P 16
C92	Ceramic	820p	50V	CKDYB 821K 50
C93	Ceramic	820p	50V	CKDYB 821K 50
C94	Ceramic	100p	50V	CCDSL 101K 50

OTHERS

Symbol	Description	Part No.
	Nut	ABN-027
	Nut	ABN-026
	Screw	ABA-078
	Screw 3x6	ABA-116

Tuner Assembly

- * The IC used at Q_5 is either PA3001, or PA3001Y, depending on the model. These two ICs are not interchangeable without a minor alteration to the circuitry. When servicing, follow the instructions described below.

Replacing PA3001 with PA3001Y

Disconnect the jumper wire to the D_{10} section. Then insert a diode (1S2076), but be careful that the direction is correct.

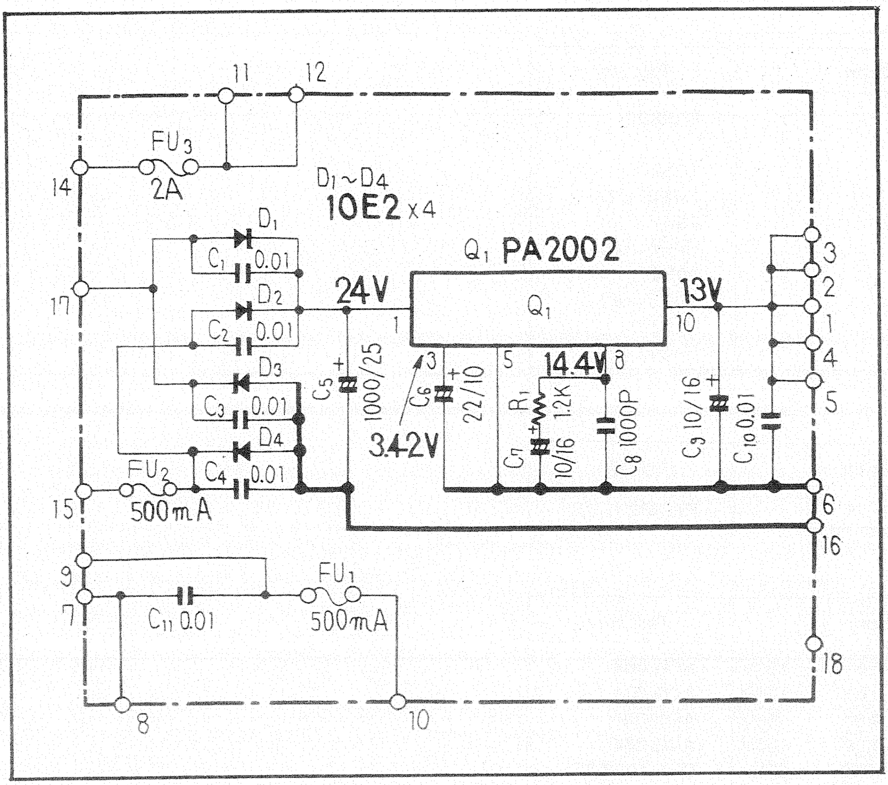
Replacing PA3001Y with PA3001

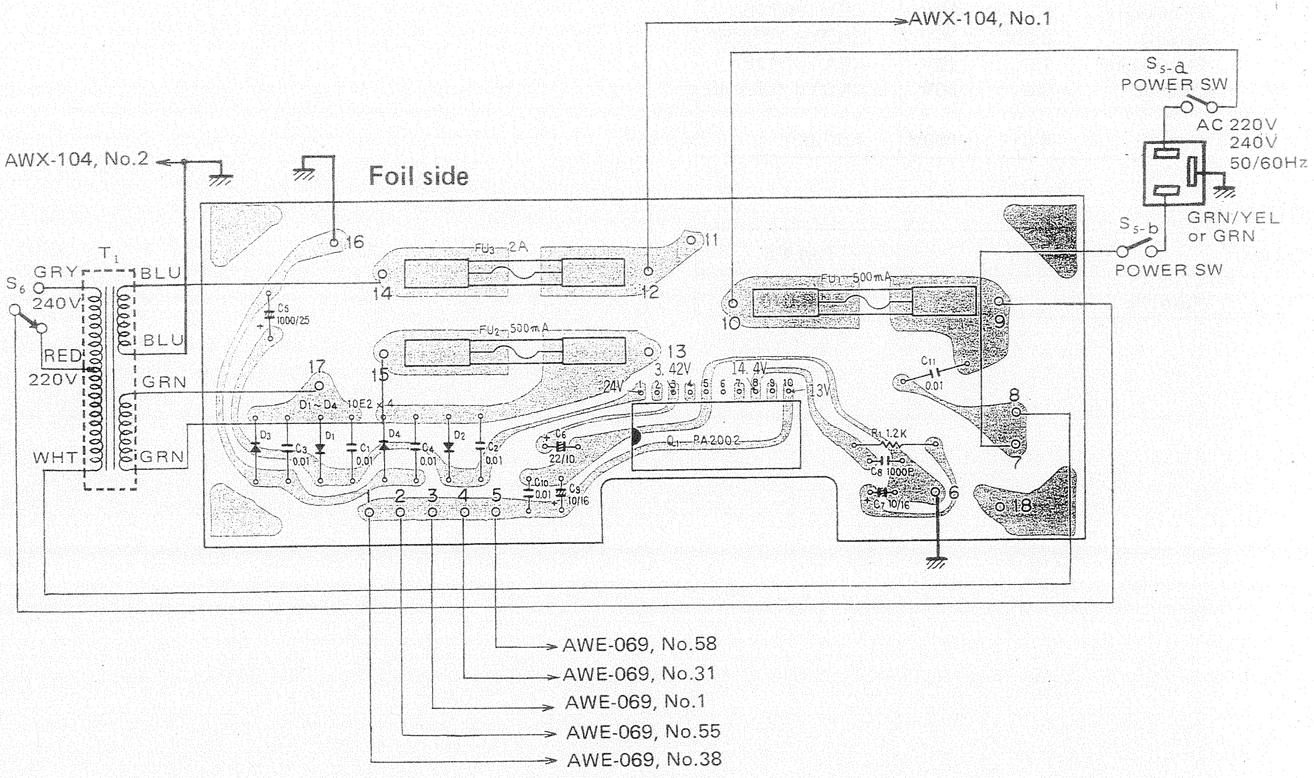
Remove diode D_{10} (1S2076), and connect the gap with a jumper wire.

How to tell PA3001 and PA3001Y apart

PA3001: the characters (PA3001) on the upper surface of the IC are "white".
PA3001Y: either the characters (PA3001) on the upper surface of the IC are "yellow", or the characters PA3001Y have been printed on.

3.3 POWER SUPPLY ASSEMBLY (AWR-133)


11
12
FU3
2A
14
D1~D4
10E2 x4
D1
C1 0.01
D2
C2 0.01
D3
C3 0.01
D4
C4 0.01
17
Q1 PA2002
Q1
24V
13V
1
10
3
5
8
14.4V
C5 1000/25
C6 22/10
3.42V
R1 1.2K
C7 10/16
C8 1000P
C9 10/16
C10 0.01
3
2
1
4
5
6
16
FU2
500mA
15
9
7
C11 0.01
FU1
500mA
18
8
10


AWX-104, No.1
S5-a
POWER SW
AC 220V
240V
50/60Hz
AWX-104, No.2
Foil side
GRN/YEL
or GRN
S5-b
POWER SW
T1
S6
GRY
240V
RED
220V
WHT
BLU
BLU
GRN
GRN
16
FU3 2A
11
14
12
C5 1000/25
FU1 500mA
10
9
FU2 500mA
13
17
15
3.42V
14.4V
24V
13V
C11 0.01
D1~D4 10E2 x4
D3
C3 0.01
D1
C1 0.01
D4
C4 0.01
D2
C2 0.01
C6 22/10
Q1 PA2002
R1 1.2K
C8 1000P
8
7
C10 0.01
C9 10/16
C7 10/16
6
18
1
2
3
4
5
AWE-069, No.58
AWE-069, No.31
AWE-069, No.1
AWE-069, No.55
AWE-069, No.38

Parts List of Power Supply Assembly (AWR-133)

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	IC	PA2002
D1	Diode	10E2 (SIB01-02)
D2	Diode	10E2 (SIB01-02)
D3	Diode	10E2 (SIB01-02)
D4	Diode	10E2 (SIB01-02)

RESISTOR

Symbol	Description	Part No.
R1	Carbon film 1.2k	RD¼PS 122J

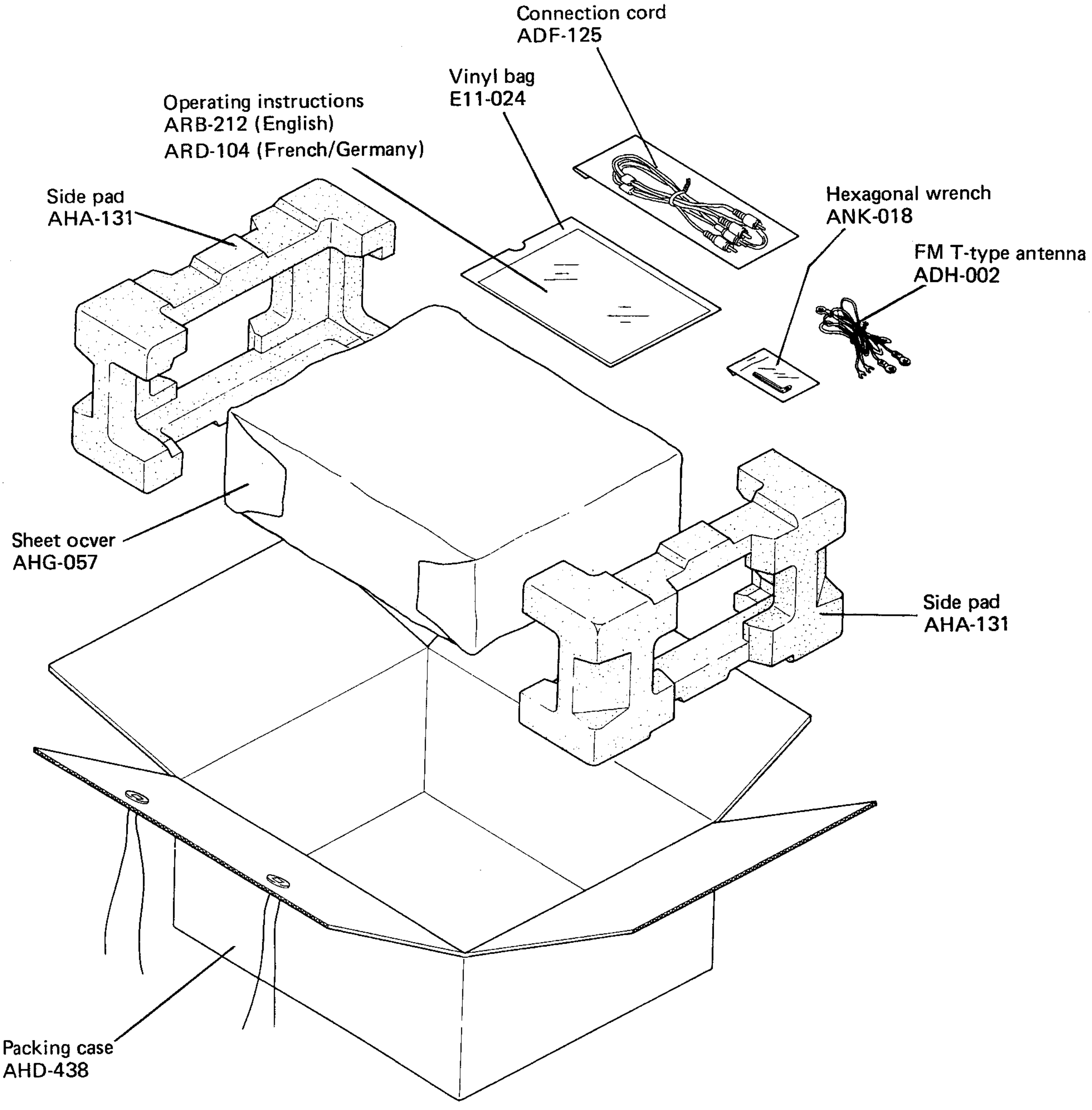
CAPACITORS

Symbol	Description			Part No.
C1	Ceramic	0.01	150V	ACG-004
C2	Ceramic	0.01	150V	ACG-004
C3	Ceramic	0.01	150V	ACG-004
C4	Ceramic	0.01	150V	ACG-004
C5	Electrolytic	1000	25V	CEA 102P 25
C6	Electrolytic	22	10V	CEA 220P 10
C7	Electrolytic	10	16V	CEA 100P 16
C8	Ceramic	0.001	50V	CKDYB 102K 50
C9	Electrolytic	10	16V	CEA 100P 16
C10	Ceramic	0.01	50V	CKDYB 103K 50
C11	Ceramic	0.01	250V	ACG-001

OTHERS

Symbol	Description	Part No.
	Fuse clip	AKR-010

3.4 PACKING


Connection cord
ADF-125
Vinyl bag
E11-024
Operating instructions
ARB-212 (English)
ARD-104 (French/Germany)
Side pad
AHA-131
Hexagonal wrench
ANK-018
FM T-type antenna
ADH-002
Sheet ocver
AHG-057
Side pad
AHA-131
Packing case
AHD-438

4. S TYPE

4.1 SCHEMATIC DIAGRAM AND MISCELLANEOUS PARTS LIST

NOTE:

- *Capacitors: in μF unless otherwise noted p:pF*
- *Resistors: in Ω, ¼W unless otherwise noted k:kΩ, M:MΩ*

Miscellaneous Parts List

SWITCHES

Symbol	Description	Part No.
S5	Lever switch (POWER)	ASK-128
S7	Plug in selector (Line voltage selector)	AKR-031

TRANSFORMERS AND COIL

Symbol	Description	Part No.
T1	Power transformer	ATT-345
T2	Bar antenna	ATB-506
T3	Ferrite balun	T22-025
L1	RF choke coil	T24-030

LAMPS

Symbol	Description	Part No.
PL1	Lamp with wire 8V, 50mA	AEL-072
PL2	Lamp with wire 6V, 30mA	AEL-080
PL3	Lamp with wire 6V, 30mA	AEL-079
PL4	Lamp with wire 6V, 30mA	AEL-079
PL5	Lamp (Wedge type) 8V, 300mA	AEL-029
PL6	Lamp (Wedge type) 8V, 300mA	AEL-029
PL7	Lamp (Wedge type) 8V, 300mA	AEL-029
PL8	Lamp (Wedge type) 8V, 300mA	AEL-029

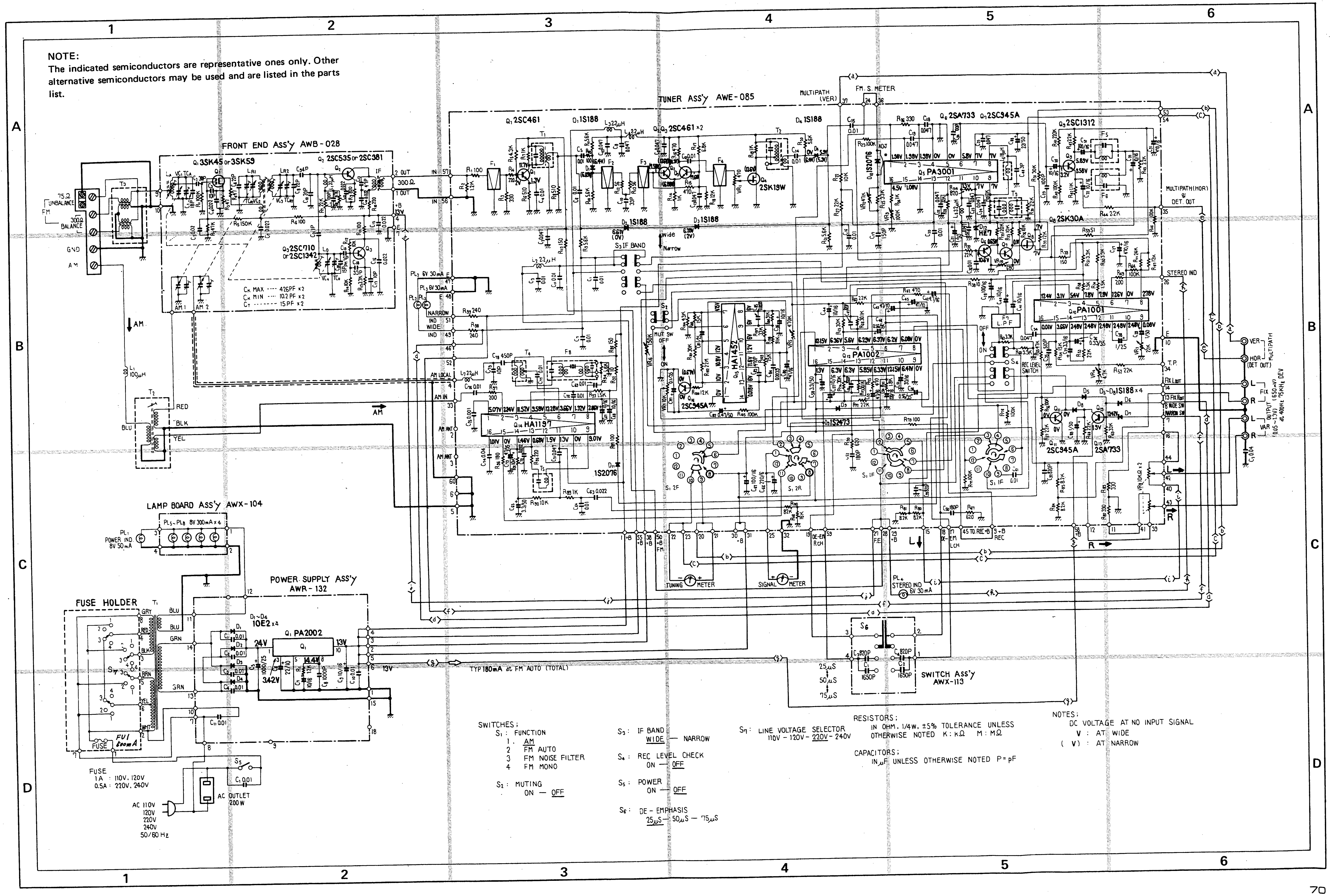
FUSE

Symbol	Description	Part No.
FU1	Fuse 500mA (Primary)	AEK-107

CAPACITORS

Symbol	Description			Part No.
C1	Ceramic	0.01	250V	ACG-001
C2	Ceramic	0.04	50V	CKDYF 403Z 50

NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.


FRONT END ASS'y AWB-028
Q1 3SK45 or 3SK59
Q2 2SC535 or 2SC381
Q3 2SC710 or 2SC1342
CK MAX ---- 426PF ×2
CK MIN ---- 10.2 PF ×2
CT ---- 15 PF ×2
TUNER ASS'y AWE-085
Q1 2SC461
D1 1S188
Q2 Q3 2SC461 ×2
D4 1S188
Q4 2SK19W
Q5 PA3001
Q6 2SA733
Q7 2SC945A
Q8 2SK30A
Q9 2SC1312
Q10 PA1001
Q11 2SC945A
Q12 PA1002
Q13 HA1156
Q14 HA1197
Q15 2SA733
Q16 2SC945A
D2 1S188
D3 1S188
D5~D8 1S188 ×4
D10 1S2076
D11 1S2076
D12 HZ7
D13 1S2473
S3 IF BAND
Wide
Narrow
MUT SW
REC LEVEL SWITCH
L.P.F
MULTIPATH (VER)
FM. S. METER
MULTIPATH (HOR) & DET. OUT
STEREO IND
VER
HOR
MULTIPATH
(DET OUT)
FIX
VAR
OUTPUT 650mV (0.5~1.3V) at 400Hz 75kHz DEV
75Ω UNBALANCE
FM
300Ω BALANCE
GND
AM
AM
L1 100μH
RED
BLU
BLK
YEL
NARROW
IND
WIDE
AM LOCAL
AM IN
AM ANT
PL2 6V 30mA
PL3 6V 30mA
S1 2F
S1 2R
S1 1F
TUNING METER
SIGNAL METER
PL4 STEREO IND 6V 30mA
LAMP BOARD ASS'y AWX-104
PL5~PL8 8V 300mA ×4
PL1 POWER IND 8V 50mA
POWER SUPPLY ASS'y AWR-132
D1~D4 10E2 ×4
Q1 PA2002
24V
13V
34.2V
FUSE HOLDER
FU1 FUSE
S7
GRY
BLU
GRN
BRN
YEL
WHT
FUSE
1A : 110V, 120V
0.5A : 220V, 240V
AC 110V
120V
220V
240V
50/60 Hz
AC OUTLET 200 W
S5
C1 0.01
TYP 180mA at FM AUTO (TOTAL)
S6
25μS
50μS
75μS
1650P
SWITCH ASS'y AWX-113
1
2
3
4
5
6
A
B
C
D

SWITCHES;
S1 : FUNCTION
1. AM
2 FM AUTO
3 FM NOISE FILTER
4 FM MONO

S2 : MUTING
ON — OFF

S3 : IF BAND
WIDE — NARROW

S4 : REC LEVEL CHECK
ON — OFF

S5 : POWER
ON — OFF

S6 : DE - EMPHASIS
25μS — 50μS — 75μS

S7 : LINE VOLTAGE SELECTOR
110V - 120V - 220V - 240V

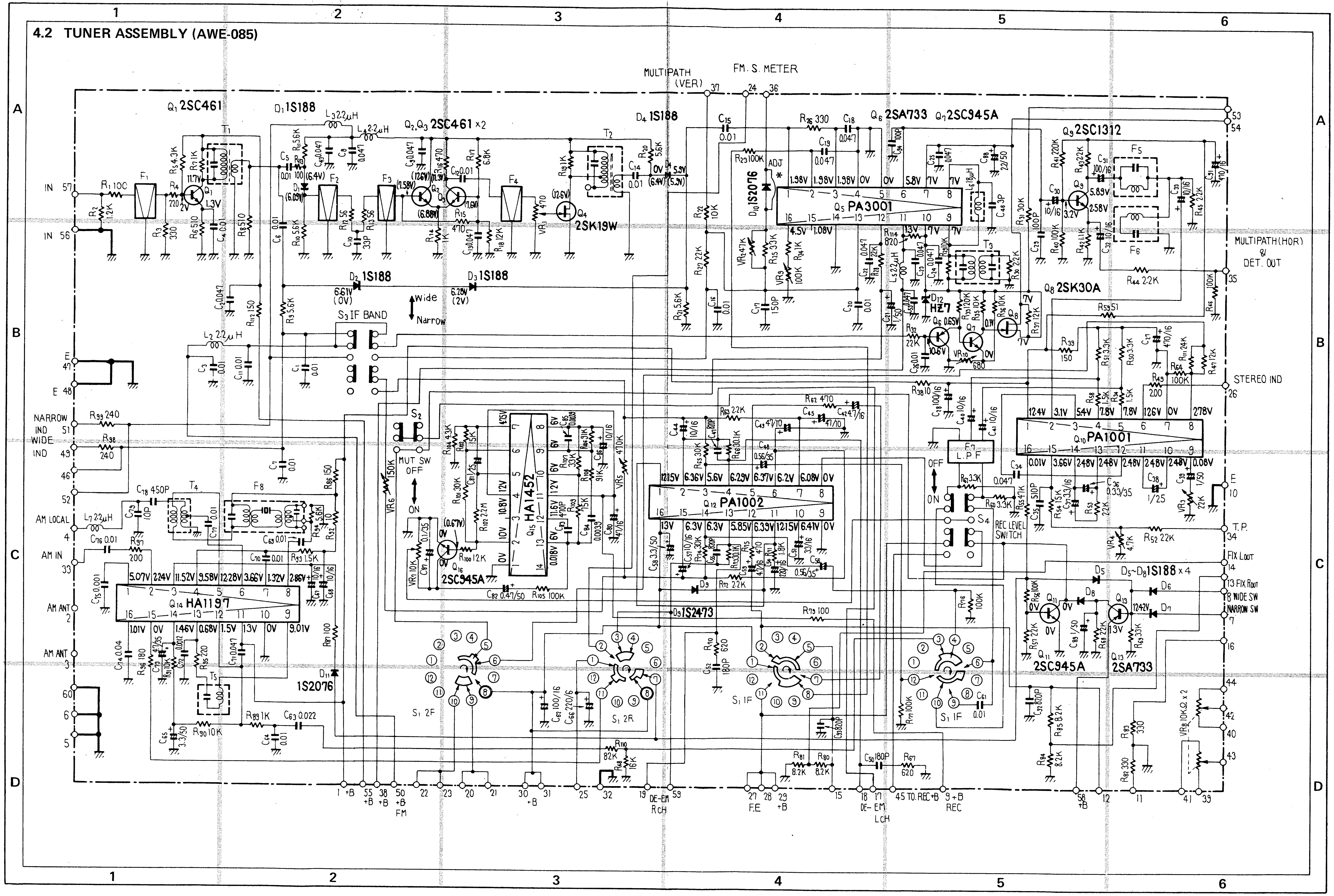
RESISTORS;
IN OHM, 1/4W, ±5% TOLERANCE UNLESS OTHERWISE NOTED K : kΩ M : MΩ

CAPACITORS;
IN μF UNLESS OTHERWISE NOTED P = pF

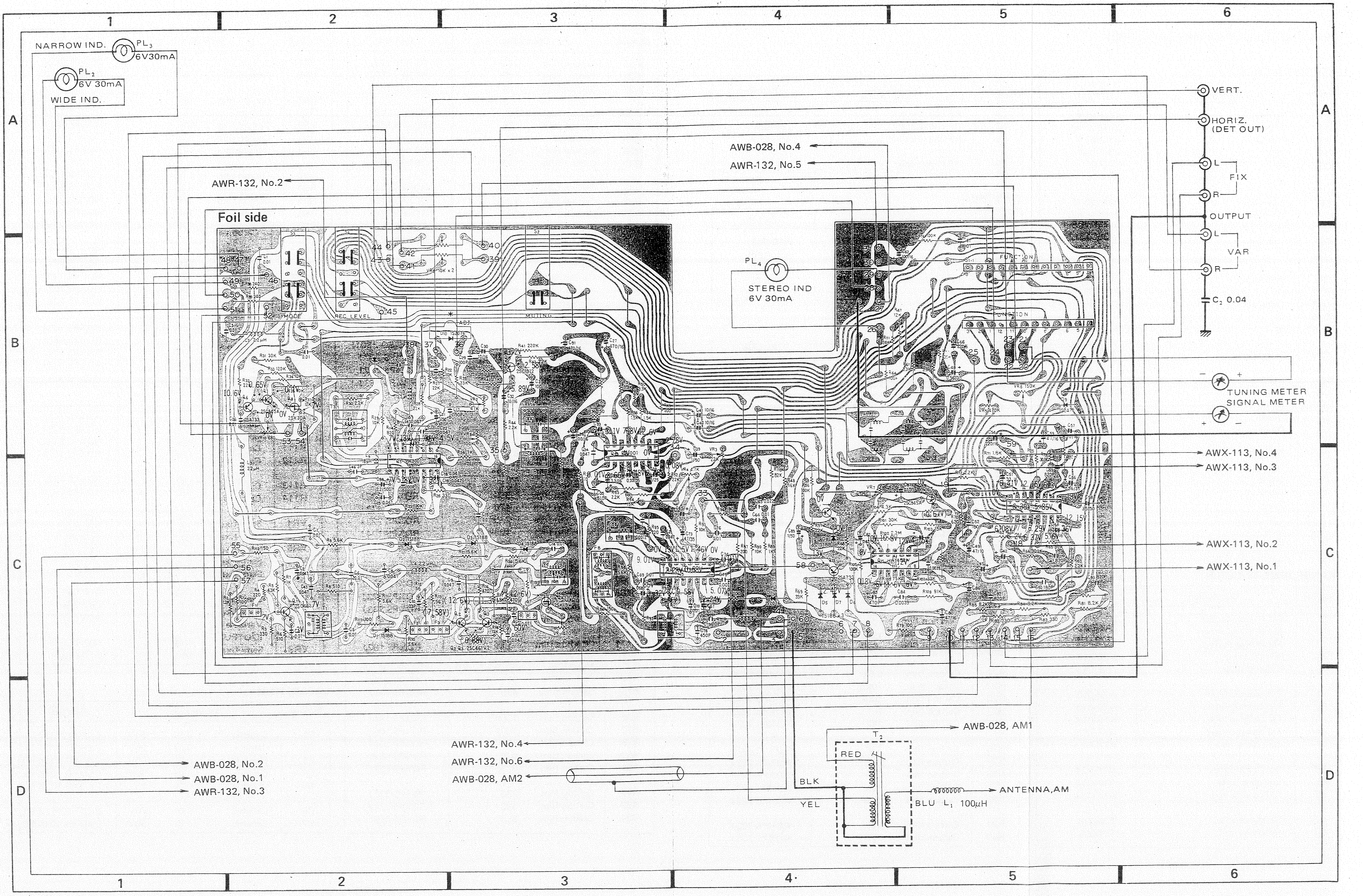
NOTES;
DC VOLTAGE AT NO INPUT SIGNAL
V : AT WIDE
(V) : AT NARROW

TX-8500II/S

4.2 TUNER ASSEMBLY (AWE-085)



1
2
3
4
5
6
A
B
C
D
MULTIPATH (VER)
FM. S. METER
37
24
36
Q1 2SC461
D1 1S188
L3 2.2μH
L4 2.2μH
Q2,Q3 2SC461 ×2
D4 1S188
R26 330
Q6 2SA733
Q7 2SC945A
Q9 2SC1312
53
54
IN 57
IN 56
R1 10C
F1
T1
F2
F3
F4
T2
Q4 2SK19W
D10 1S2076
ADJ
Q5 PA3001
D12 HZ7
T3
F5
F6
Q8 2SK30A
MULTIPATH (HOR) & DET. OUT
35
D2 1S188
D3 1S188
Wide
Narrow
S3 IF BAND
L2 2.2μH
E 47
E 48
NARROW IND 51
WIDE IND 49
46
52
AM LOCAL 4
AM IN 33
AM ANT 2
AM ANT 3
60
6
5
R99 240
R98 240
S2
MUT SW OFF
ON
VR6 150K
Q15 HA1452
Q16 2SC945A
VR5 470K
Q12 PA1002
Q10 PA1001
F7 L.P.F
STEREO IND 26
OFF
ON
S4 REC LEVEL SWITCH
E 10
T.P. 34
FIX Lout 14
13 FIX Rout
8 WIDE SW
NARROW SW 7
16
44
42
40
43
D5~D8 1S188 ×4
Q11 2SC945A
Q13 2SA733
VR8 10KΩ×2
T4
F8
L7 2.2μH
Q14 HA1197
T5
D11 1S2076
D9 1S2473
S1 2F
S1 2R
S1 IF
S1 IF
1 +B
55 +B
38 +B
50 +B FM
22
23
20
21
30 +B
31
25
32
19 DE-EM RCH
59
27 F.E
28
29 +B
15
18
17 DE-EM LCH
45 TO. REC
9 +B REC
58 +B
12
11
41
39


Foil side
NARROW IND.
PL3
6V30mA
PL2
6V 30mA
WIDE IND.
AWR-132, No.2
AWB-028, No.4
AWR-132, No.5
PL4
STEREO IND
6V 30mA
VERT.
HORIZ.
(DET OUT)
L
R
FIX
OUTPUT
L
R
VAR
C2 0.04
TUNING METER
SIGNAL METER
AWX-113, No.4
AWX-113, No.3
AWX-113, No.2
AWX-113, No.1
MODE
REC LEVEL
MUTING
FUNCTION
AWR-132, No.4
AWR-132, No.6
AWB-028, AM2
AWB-028, AM1
T2
RED
BLK
YEL
BLU
L1 100μH
ANTENNA,AM
AWB-028, No.2
AWB-028, No.1
AWR-132, No.3
1
2
3
4
5
6
A
B
C
D

Parts List of Tuner Assembly (AWE-085)

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	Transistor	2SC461-B
Q2	Transistor	2SC461-B
Q3	Transistor	2SC461-B
Q4	FET	2SK19-W
* Q5	IC	PA3001 (PA3001Y)
Q6	Transistor	2SA733-Q
Q7	Transistor	2SC945A-Q
Q8	FET	2SK30A-Y
Q9	Transistor	2SC1312-G
Q10	IC	PA1001
Q11	Transistor	2SC945A-Q
Q12	IC	PA1002
Q13	Transistor	2SA733-Q
Q14	IC	HA1197
Q15	IC	HA1452W
Q16	Transistor	2SC945A-Q
D1	Diode	1S188FM-1
D2	Diode	1S188FM-1
D3	Diode	1S188FM-1
D4	Diode	1S188FM-1
D5	Diode	1S188FM-1
D6	Diode	1S188FM-1
D7	Diode	1S188FM-1
D8	Diode	1S188FM-1
D9	Diode	1S2473
* D10	Diode	1S2076
D11	Diode	1S2076
D12	Zener diode	HZ7-B

TRANSFORMERS, COILS

Symbol	Description	Part No.
T1	FM IF transformer	ATE-023
T2	FM IF transformer	ATE-024
T3	FM IF transformer	T73-035
T4	AM OSC coil	ATB-019
T5	455kHz filter	ATF-013
F1	FM ceramic filter	ATF-013
F2	FM ceramic filter	ATF-013
F3	FM ceramic filter	ATF-013
F4	FM ceramic filter	ATF-013
F5	Anti-birdy filter	ATF-023
F6	Anti-birdy filter	ATF-024
F7	Low pass filter	ATF-036
F8	AM ceramic filter	ATF-034
L2	RF choke coil	T24-028
L3	RF choke coil	T24-028
L4	RF choke coil	T24-028
L5	RF choke coil	T24-028
L6	RF choke coil	ATH-007
L7	RF choke coil	T24-028

SWITCHES

Symbol	Description	Part No.
S1	Rotary switch (FUNCTION)	ASD-063
S2	Lever switch (FM MUTING)	ASK-109
S3	Lever switch (IF BAND)	ASK-112
S4	Lever switch (REC LEVEL CHECK)	ASK-112

RESISTORS

Symbol	Description	Part No.
R1	Carbon film 100	RD¼PS 101J
R2	Carbon film 1.2k	RD¼PS 122J
R3	Carbon film 330	RD¼PS 331J
R4	Carbon film 220	RD¼PS 221J
R5	Carbon film 4.3k	RD¼PS 432J
R6	Carbon film 510	RD¼PS 511J
R7	Carbon film 1k	RD¼PS 102J
R8	Carbon film 510	RD¼PS 511J
R9	Carbon film 5.6k	RD¼PS 562J
R10	Carbon film 5.6k	RD¼PS 562J
R11	Carbon film 5.6k	RD¼PS 562J
R12	Carbon film 56	RD¼PS 560J
R13	Carbon film 56	RD¼PS 560J
R14	Carbon film 1k	RD¼PS 102J
R15	Carbon film 470	RD¼PS 471J
R16	Carbon film 470	RD¼PS 471J
R17	Carbon film 6.8k	RD¼PS 682J
R18	Carbon film 12k	RD¼PS 123J
R19	Carbon film 1k	RD¼PS 102J
R20	Carbon film 5.6k	RD¼PS 562J
R21	Carbon film 5.6k	RD¼PS 562J
R22	Carbon film 10k	RD¼PS 103J
R23	Carbon film 100k	RD¼PS 104J
R24	Carbon film 1k	RD¼PS 102J
R25	Carbon film 33k	RD¼PS 333J
R26	Carbon film 330	RD¼PS 331J
R27	Carbon film 22k	RD¼PS 223J
R28	Carbon film 2.2k	RD¼PS 222J
R29	Carbon film 10k	RD¼PS 103J
R30	Carbon film 2.2k	RD¼PS 222J
R31	Carbon film 30k	RD¼PS 303J
R32	Carbon film 22k	RD¼PS 223J
R33	Carbon film 120k	RD¼PS 124J
R34	Carbon film 1.5k	RD¼PS 152J
R35	Carbon film 10k	RD¼PS 103J
R36	Carbon film 10k	RD¼PS 103J
R37	Carbon film 12k	RD¼PS 123J
R38	Carbon film 10	RD¼PS 100J
R39	Carbon film 150	RD¼PS 151J
R40	Carbon film 100k	RD¼PS 104J
R41	Carbon film 220k	RD¼PS 224J
R42	Carbon film 1.1k	RD¼PS 112J
R43	Carbon film 2.2k	RD¼PS 222J
R44	Carbon film 2.2k	RD¼PS 222J
R45	Carbonf ilm 2.2k	RD¼PS 222J
R46	Carbon film 100k	RD¼PS 104J
R47	Carbon film 12k	RD¼PS 123J
R48	Carbon film 16k	RD¼PS 163J
R49	Carbon film 200	RD¼PS 201J
R50	Metal film 3.3k ⅕W	RN⅕SQ 3301F
R51	Metal film 3.3k ⅕W	RN⅕SQ 3301F
R52	Carbon film 22k	RD¼PS 223J
R53	Carbon film 2.2k	RD¼PS 222J
R54	Carbon film 15k	RD¼PS 153J
R55	Carbon film 47k	RD¼PS 473J
R56	Carbon film 100k	RD¼PS 104J
R57	Carbon film 22k	RD¼PS 223J
R58	Carbon film 1.5k	RD¼PS 152J
R59	Carbon film 51	RD¼PS 510J
R60	Carbon film 3.3k	RD¼PS 332J
R61	Carbon film 3.3k	RD¼PS 332J
R62	Carbon film 470	RD¼PS 471J
R63	Carbon film 2.2k	RD¼PS 222J
R64	Carbon film 100k	RD¼PS 104J
R65	Carbon film 30k	RD¼PS 303J
R66	Metal film 30.1k ⅕W	RN⅕SQ 3012F
R67	Carbon film 620	RD¼PS 621J
R68	Carbon film 22k	RD¼PS 223J
R69	Carbon film 33k	RD¼PS 333J
R70	Carbon film 620	RD¼PS 621J
R71	Carbon film 1.8k	RD¼PS 182J
R72	Carbon film 2.2k	RD¼PS 222J
R73	Metal film 30.1k ⅕W	RN⅕SQ 3012F
R74	Carbon film 30k	RD¼PS 303J
R75	Carbon film 470	RD¼PS 471J
R76	Carbon film 100k	RD¼PS 104J
R77	Carbon film 100k	RD¼PS 104J
R79	Carbon film 100	RD¼PS 101J
R80	Carbon film 8.2k	RD¼PS 822J
R81	Carbon film 8.2k	RD¼PS 822J
R82	Carbon film 330	RD¼PS 331J
R83	Carbon film 330	RD¼PS 331J
R84	Carbon film 8.2k	RD¼PS 822J
R85	Carbon film 8.2k	RD¼PS 822J
R86	Carbon film 150	RD¼PS 151J
R87	Carbon film 100	RD¼PS 101J
R89	Carbon film 1k	RD¼PS 102J
R90	Carbon film 10k	RD¼PS 103J
R91	Carbon film 10k	RD¼PS 103J
R92	Carbon film 10	RD¼PS 100J
R93	Carbon film 1.5k	RD¼PS 152J
R94	Carbon film 5.6k	RD¼PS 562J
R95	Carbon film 220	RD¼PS 221J
R96	Carbon film 180	RD¼PS 181J
R97	Carbon film 200	RD¼PS 201J
R98	Carbon film 240	RD¼PS 241J
R99	Carbon film 240	RD¼PS 241J
R100	Carbon film 12k	RD¼PS 123J
R101	Carbon film 30k	RD¼PS 303J
R102	Carbon film 2.2M	RD¼PS 225J
R103	Carbon film 15k	RD¼PS 153J
R104	Carbon film 4.3k	RD¼PS 432J
R105	Carbon film 100k	RD¼PS 104J
R106	Carbon film 91k	RD¼PS 913J
R107	Carbon film 33k	RD¼PS 333J
R108	Carbon film 91k	RD¼PS 913J
R109	Carbon film 75k	RD¼PS 753J
R110	Carbon film 82k	RD¼PS 823J
R111	Carbon film 24k	RD¼PS 243J
R112	Carbon film 150	RD¼PS 151J
R113	Carbon film 100	RD¼PS 101J
R114	Carbon film 820	RD¼PS 821J
VR1	Semi-fixed 470	ACP-006
VR2	Semi-fixed 47k	C92-048
VR3	Semi-fixed 22k	ACP-056
VR4	Semi-fixed 4.7k	C92-051
VR5	Semi-fixed 470k	ACP-011
VR6	Semi-fixed 150k	ACP-057
VR7	Semi-fixed 10k	C92-049
VR8	Variable resistor 10k (OUTPUT LEVEL)	ACV-178
VR9	Semi-fixed 100k	C92-047
VR10	Semi-fixed 680	ACP-013

CAPACITORS

Symbol	Description	Part No.
C1	Ceramic 0.01 50V	CKDYF 103Z 50
C2	Ceramic 0.047 25V	CKDBC 473Z 25
C3	Ceramic 0.01 50V	CKDYB 103K 50
C4	Ceramic 0.01 50V	CKDYB 103K 50
C5	Ceramic 0.01 50V	CKDYF 103Z 50
C6	Ceramic 0.01 50V	CKDYF 103Z 50
C7	Ceramic 0.01 50V	CKDYB 103K 50

Symbol	Description			Part No.
C8	Ceramic	0.047	25V	CKDBC 473Z 25
C9	Ceramic	0.047	25V	CKDBC 473Z 25
C10	Ceramic	33p	50V	CCDSL 330K 50
C11	Ceramic	0.01	50V	CKDYB 103K 50
C12	Ceramic	0.01	50V	CKDYF 103Z 50
C13	Ceramic	0.047	25V	CKDBC 473Z 25
C14	Ceramic	0.01	50V	CKDYF 103Z 50
C15	Ceramic	0.01	50V	CKDYF 103Z 50
C16	Ceramic	0.01	50V	CKDYF 103Z 50
C17	Ceramic	150p	50V	CCDSL 151K 50
C18	Ceramic	0.047	25V	CKDBC 473Z 25
C19	Ceramic	0.047	25V	CKDBC 473Z 25
C20	Ceramic	0.01	50V	CKDYB 103K 50
C21	Electrolytic	1	50V	CEA 010P 50
C22	Ceramic	0.047	25V	CKDBC 473Z 25
C23	Ceramic	0.047	25V	CKDBC 473Z 25
C24	Ceramic	0.047	25V	CKDBC 473Z 25
C25	Ceramic	0.047	25V	CKDBC 473Z 25
C26	Ceramic	0.01	50V	CKDYF 103Z 50
C27	Electrolytic	470	16V	CEA 471P 16
C28	Electrolytic	100	16V	CEA 101P 16
C29	Ceramic	100p	50V	CCDSL 101K 50
C30	Electrolytic	10	16V	CSZA 100M 16
C31	Electrolytic	100	16V	CEA 101P 16
C32	Electrolytic	10	16V	CSZA 100M 16
C33	Electrolytic	10	16V	CEANL 100P 16
C34	Mylar	0.047	50V	CQMA 473K 50
C35	Polystyrene	510p	50V	CQSH 511J 50
C36	Electrolytic	0.33	35V	CSZA R33M 35
C37	Electrolytic	3.3	16V	CSZA 3R3M 16
C38	Electrolytic	1	25V	CSZA 010M 25
C39	Electrolytic	1	50V	CEA 010P 50
C40	Electrolytic	10	16V	CSZA 100M 16
C41	Electrolytic	10	16V	CSZA 100M 16
C42	Electrolytic	4.7	25V	CEANL 4R7P 25
C43	Ceramic	0.047	25V	CKDBC 473Z 25
C44	Electrolytic	10	16V	CSZA 100M 16
C45	Electrolytic	47	10V	CEA 470P 10
C46	Ceramic	3p	50V	CCDSL 030C 50
C47	Polystyrene	820p	50V	CQSA 821G 50
C48	Electrolytic	0.56	35V	CSZA R56K 35
C49	Electrolytic	47	10V	CEA 470P 10
C50	Ceramic	180p	50V	CCDSL 181K 50
C51	Electrolytic	33	16V	ACH-321
C52	Ceramic	180p	50V	CCDSL 181K 50
C53	Ceramic	0.047	25V	CKDBC 473Z 25
C54	Electrolytic	220	16V	CEA 221P 16
C55	Polystyrene	820p	50V	CQSA 821G 50
C56	Electrolytic	0.56	35V	CSZA R56K 35
C57	Electrolytic	10	16V	CSZA 100M 16
C58	Electrolytic	3.3	50V	CEA 3R3P 50
C59	Electrolytic	4.7	25V	CEANL 4R7P 25
C60	....			....
C61	Mylar	0.01	50V	CQMA 103J 50
C62	Electrolytic	100	16V	CEA 101P 16
C63	Mylar	0.022	50V	CQMA 223J 50
C64	Mylar	0.01	50V	CQMA 103K 50
C65	Electrolytic	3.3	50V	CEA 3R3P 50
C66	Electrolytic	220	6V	CEA 221P 6
C67	Electrolytic	10	16V	CEA 100P 16
C68	Electrolytic	10	16V	CEA 100P 16
C69	Ceramic	0.01	50V	CKDYF 103Z 50
C70	Ceramic	0.01	50V	CKDYF 103Z 50
C71	Ceramic	0.047	25V	CKDBC 473Z 25
C72	Ceramic	1200p	50V	CKDYB 122K 50
C73	Electrolytic	4.7	35V	CEA 4R7P 35
C74	Ceramic	0.04	50V	CKDYF 403Z 50
C75	Ceramic	0.001	50V	CKDYB 102K 50
C76	Ceramic	0.01	50V	CKDYF 103Z 50
C77	Ceramic	0.01	50V	CKDYF 103Z 50
C78	Polystyrene	450p	50V	CQSA 451J 50
C79	Ceramic	10p	50V	CCDWK 100F 50
C80	Electrolytic	47	16V	CEA 470P 16
C81	Electrolytic	1	25V	CSZA 010M 25
C82	Electrolytic	0.47	50V	CEA R47P 50
C83	Ceramic	470p	50V	CKDYB 471K 50
C84	Mylar	0.0039	50V	CQMA 392J 50
C85	Mylar	0.0039	50V	CQMA 392J 50
C86	Electrolytic	10	16V	CEA 100P 16
C87	Electrolytic	0.1	35V	CSZA 0R1M 35
C88	Electrolytic	2.2	50V	CEA 2R2P 50
C89	Electrolytic	1	50V	CEA 010P 50
C90	....			....
C91	Electrolytic	470	16V	CEA 471P 16
C92	Ceramic	820p	50V	CKDYB 821K 50
C93	Ceramic	820p	50V	CKDYB 821K 50
C94	Ceramic	100p	50V	CCDSL 101K 50

OTHERS

Symbol	Description	Part No.
	Nut	ABN-027
	Nut	ABN-026
	Screw	ABA-078
	Screw 3x6	ABA-116

* The IC used at Q_5 is either PA3001, or PA3001Y, depending on the model. These two ICs are not interchangeable without a minor alteration to the circuitry. When servicing, follow the instructions described below.

Replacing PA3001 with PA3001Y

Disconnect the jumper wire to the D_{10} section. Then insert a diode (1S2076), but be careful that the direction is correct.

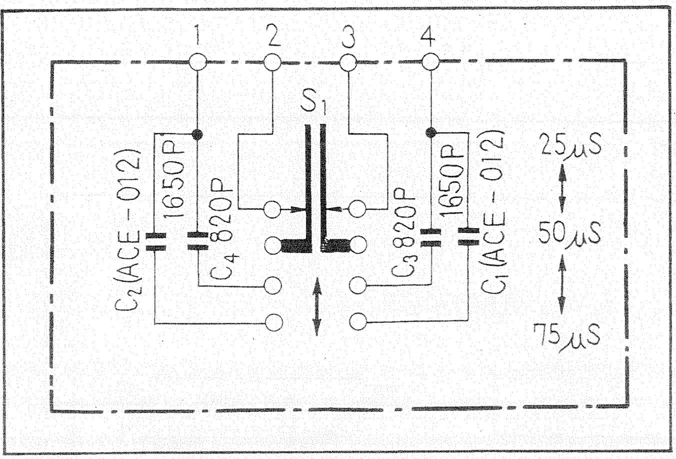
Replacing PA3001Y with PA3001

Remove diode D_{10} (1S2076), and connect the gap with a jumper wire.

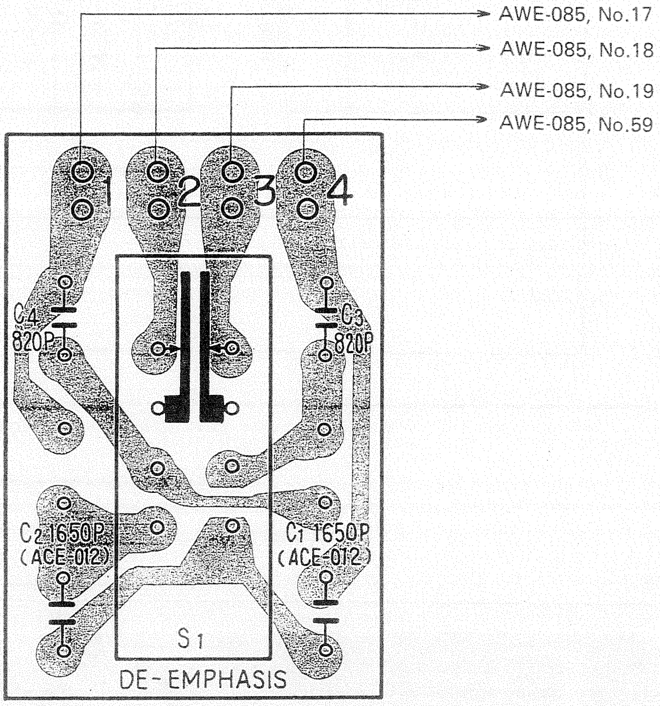
How to tell PA3001 and PA3001Y apart

PA3001: the characters (PA3001) on the upper surface of the IC are "white".
PA3001Y: either the characters (PA3001) on the upper surface of the IC are "yellow", or the characters PA3001Y have been printed on.

4.3 SWITCH ASSEMBLY (AWX-113)


1
2
3
4
S1
C2(ACE-012)
1650P
C4 820P
C3 820P
1650P
C1(ACE-012)
25μS
50μS
75μS

Foil side


AWE-085, No.17
AWE-085, No.18
AWE-085, No.19
AWE-085, No.59
1
2
3
4
C4 820P
C3 820P
C2 1650P (ACE-012)
C1 1650P (ACE-012)
S1
DE-EMPHASIS

Parts List

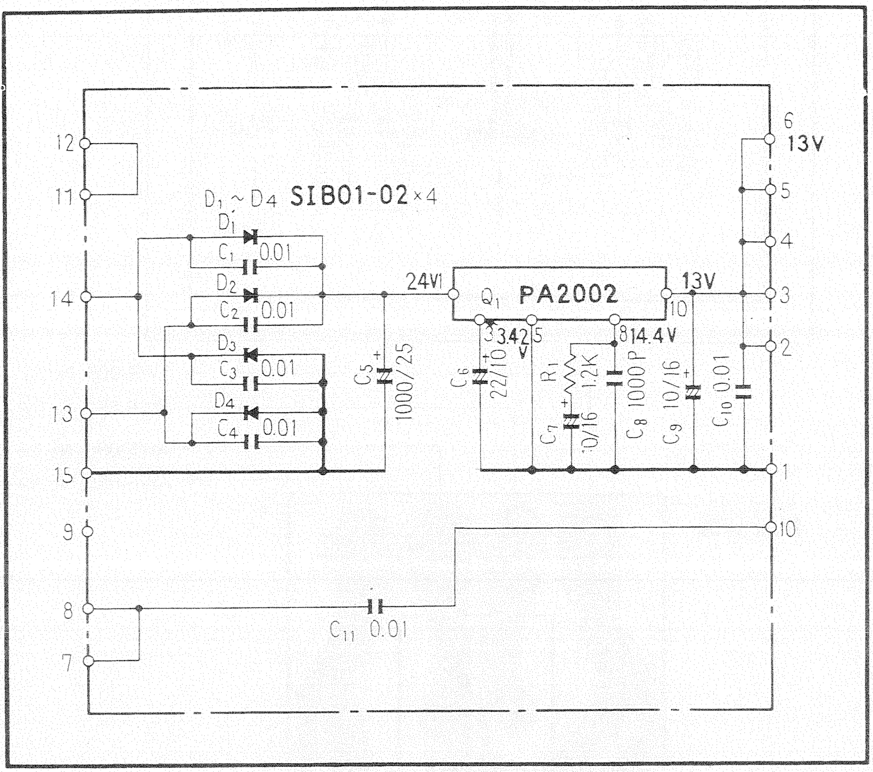
SWITCH

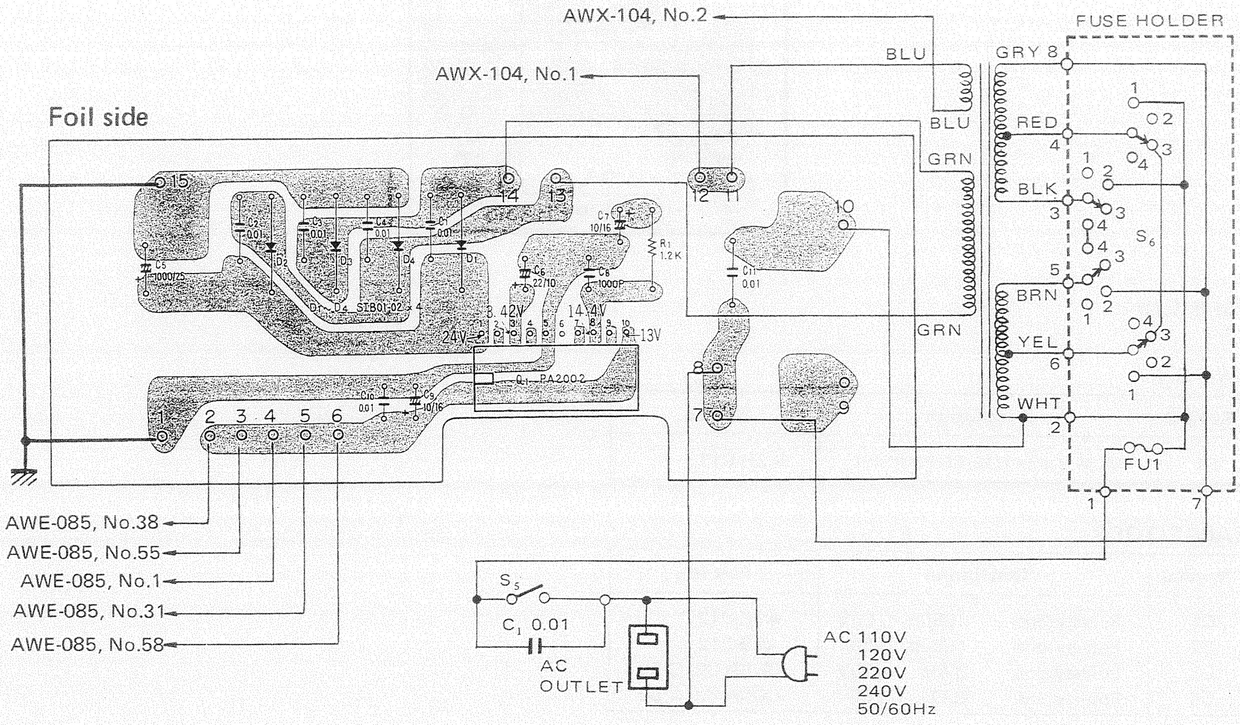
Symbol	Description	Part No.
S1	Slide switch (DE-EMPHASIS)	ASH-017

CAPACITORS

Symbol	Description			Part No.
C1	Polystyrene	1650p	50V	ACE-012
C2	Polystyrene	1650p	50V	ACE-012
C3	Polystyrene	820p	50V	CQSA 821G 50
C4	Polystyrene	820p	50V	CQSA 821G 50

4.4 POWER SUPPLY ASSEMBLY (AWR-132)


12
11
14
13
15
9
8
7
D1 ~ D4 SIB01-02×4
D1
C1 0.01
D2
C2 0.01
D3
C3 0.01
D4
C4 0.01
C5 1000/25
24V
Q1 PA2002
3 3.42V
5
8 14.4V
10
13V
C6 22/10
R1 1.2K
C7 10/16
C8 1000P
C9 10/16
C10 0.01
C11 0.01
6
13V
5
4
3
2
1
10


Foil side
AWX-104, No.2
AWX-104, No.1
BLU
BLU
GRN
GRN
GRY 8
RED 4
BLK 3
5
BRN
YEL 6
WHT 2
FUSE HOLDER
S6
FU1
1
7
15
14
13
12
11
10
C5 1000/25
C1 0.01
C2 0.01
C3 0.01
C4 0.01
D1~D4 SIB01-02×4
C6 22/10
C7 10/16
C8 1000P
R1 1.2K
C11 0.01
C9 10/16
C10 0.01
3.42V
14.4V
24V
13V
Q1 PA2002
1 2 3 4 5 6
8
7
AWE-085, No.38
AWE-085, No.55
AWE-085, No.1
AWE-085, No.31
AWE-085, No.58
S5
C1 0.01
AC OUTLET
AC 110V
120V
220V
240V
50/60Hz

Parts List of Power Supply Assembly (AWR-132)

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	IC	PA2002
D1	Diode	10E2 (SIB01-02)
D2	Diode	10E2 (SIB01-02)
D3	Diode	10E2 (SIB01-02)
D4	Diode	10E2 (SIB01-02)

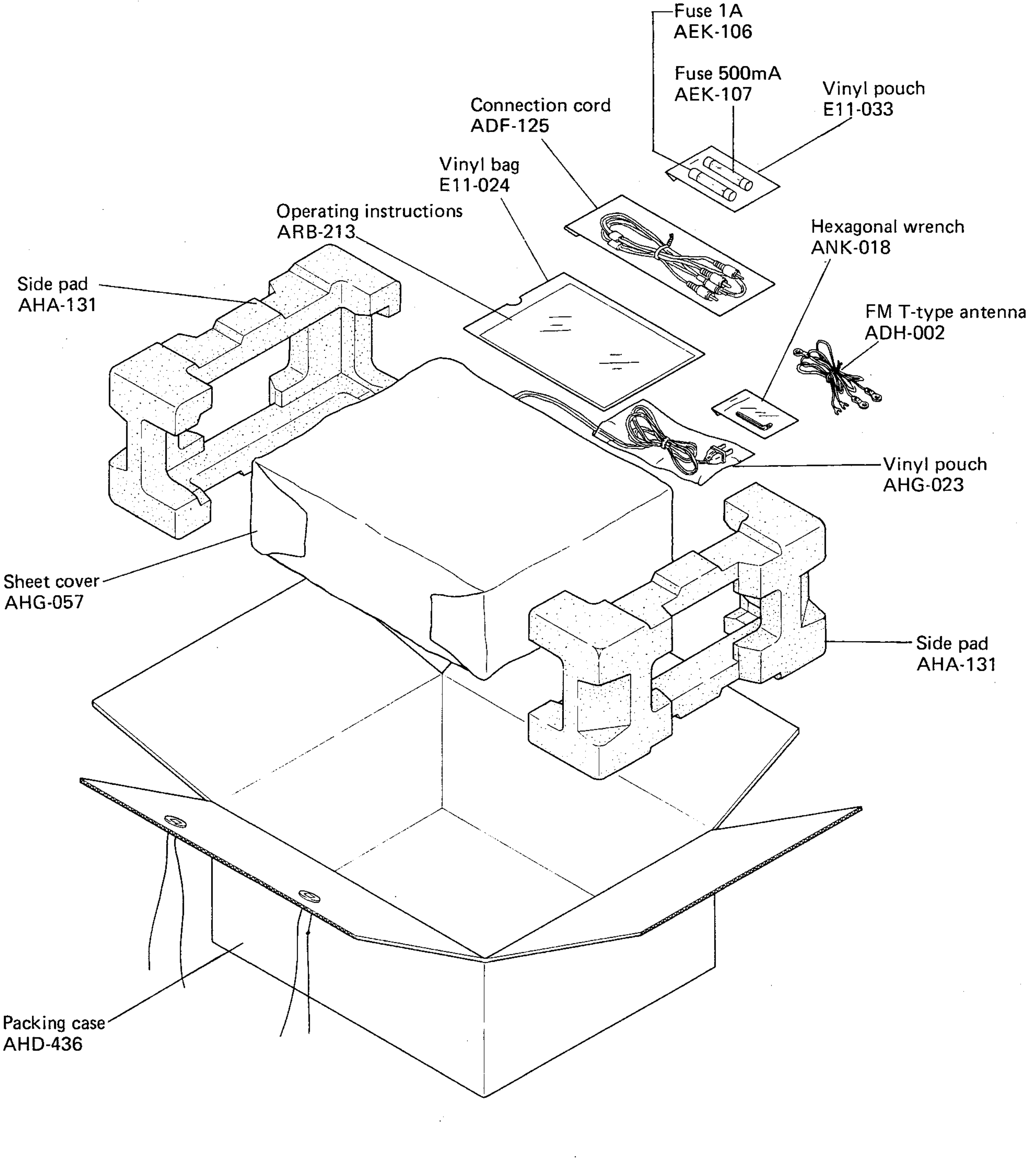
RESISTOR

Symbol	Description	Part No.
R1	Carbon film 1.2k	RD¼PS 122J

CAPACITORS

Symbol	Description			Part No.
C1	Ceramic	0.01	150V	ACG-004
C2	Ceramic	0.01	150V	ACG-004
C3	Ceramic	0.01	150V	ACG-004
C4	Ceramic	0.01	150V	ACG-004
C5	Electrolytic	1000	25V	CEA 102P 25
C6	Electrolytic	22	10V	CEA 220P 10
C7	Electrolytic	10	16V	CEA 100P 16
C8	Ceramic	0.001	50V	CKDYB 102K 50
C9	Electrolytic	10	16V	CEA 100P 16
C10	Ceramic	0.01	50V	CKDYB 103K 50
C11	Ceramic	0.01	250V	ACG-001

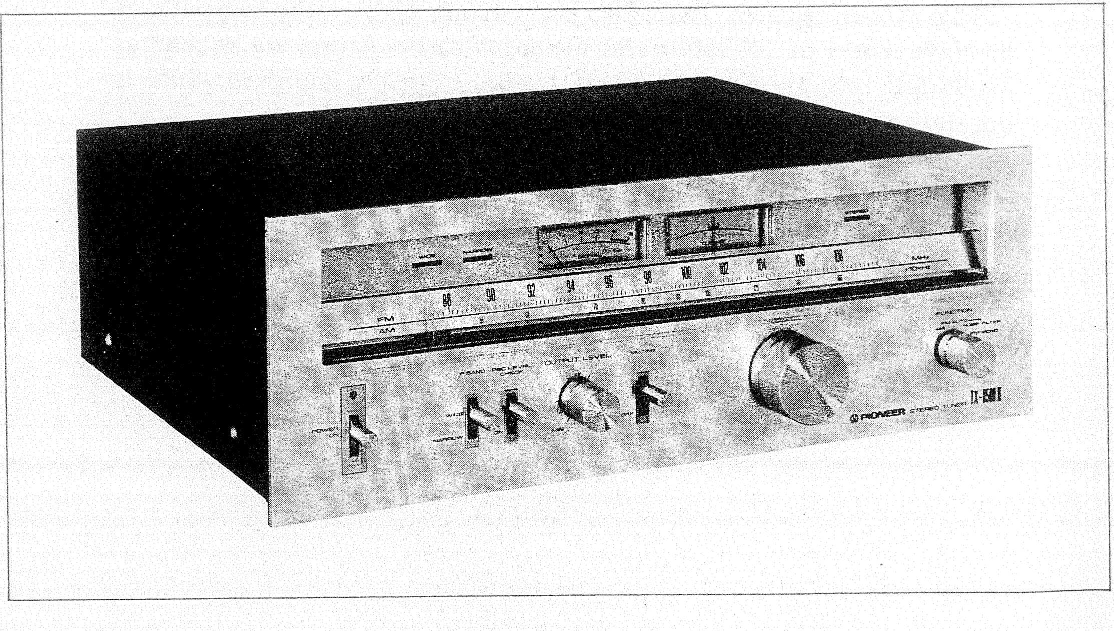
4.5 PACKING


Fuse 1A
AEK-106
Fuse 500mA
AEK-107
Vinyl pouch
E11-033
Connection cord
ADF-125
Vinyl bag
E11-024
Operating instructions
ARB-213
Hexagonal wrench
ANK-018
Side pad
AHA-131
FM T-type antenna
ADH-002
Vinyl pouch
AHG-023
Sheet cover
AHG-057
Side pad
AHA-131
Packing case
AHD-436

Technical Manual

Vol. 2

stereo tuner
TX-8500II



PIONEER®

PLANNING CONCEPT

Performance on a tuner system has been rapidly improved since IC engineering was introduced into the Hi-Fi field. The use of ICs saves us considerable cost at manufacturing level and it also provides stable performance and reliability for the users to enjoy Hi-Fi sound for a long time without any inconvenience.

This time, Pioneer developed four new ICs which are used for new tuner line-up. That means Pioneer developed many ICs in the past, but those ICs were used or copied by many other manufacturers, so naturally differences among manufacturers were getting smaller.

One of ICs is for FM-IF. It particularly improved the signal to noise ratio, for example, if this IC is used in a previous tuner of which the signal to noise ratio is 68dB to 70dB, it becomes 75dB. One more IC which we would like to introduce is a FM-MPX IC. The PLL circuits and 19kHz auto pilot signal canceller circuits are built in it. Conventional unit used to employ a low pass filter and it caused high frequency to decrease, however, the use of new IC improved performance a lot and the 15kHz decrease became only –0.5dB.

So far, only Pioneer is using the IC-equipped 19kHz pilot signal auto canceller circuit. Only few other manufacturers are using this circuit with many transistors currently on the market.

This model replaces TX-7500. The circuits employ the same ICs as up-grade model of TX-9500II. So the specification figures are as good as TX-9500II too. Moreover, the tonal quality is greatly improved which is not shown up in the specification list.

An easy way of selling tuners at retailers is to appeal specifications, especially FM sensitivity and FM selectivity. That is fine with this model, however, the retail sales will increase by "let them hear it."

TX-8500II has many features that are explained on the next page. Those features and performance will be strong enough to compete with the others.

TX-8500II MAJOR FEATURES

1. **Automatic Pilot Signal Cancelling Circuit in Newly Developed IC Results in Outstanding Frequency Characteristics**

   Previous multiplex circuit designs have usually depended on low pass filters to remove the 19kHz pilot signal and 23kHz to 53kHz subcarriers after demodulation. Such filters, however, also remove some of the wanted signals, resulting in loss of fidelity.
   The new IC (PA1001) developed by Pioneer features an automatic pilot signal cancelling circuit which removes the 19kHz carrier leak without any loss in frequency characteristics at all. Remaining subcarriers are removed by 5-element low pass filters.

   Frequency Characteristics: 20Hz–10kHz (±0.2dB)
   20Hz–15kHz (+0.2dB, –0.5dB)
   Carrier Leakage: –72dB

2. **Use of 4 Advanced IC's Greatly Diminishes Distortion and Improves S-N Ratio**

   Adoption of 4 recently developed IC's has reduced distortion, and improved S-N ratio almost beyond the limits of measurable levels. Besides the improved S-N ratio in the IF stage (PA3001) and reduced residual ripple in the power supply (PA2002), all switching and inter-station noises have been eliminated (PA1002).

   S-N Ratio: 79dB (mono)
   75dB (stereo)

3. **IF Amplifier Featuring Wide and Narrow Switchable Bandwidths**

   The wide band employs a single dual-element ceramic filter in the IF amplifier stage for high-fidelity low-distortion reception of stronger signals, while the narrow band employs 4 such filters for greater selectivity and less interference in reception of weaker signals.

   Wide: Harmonic Distortion 0.1% (stereo), 0.08% (mono)
   Narrow: Alternate Channel Selectivity 60dB (300kHz), 80dB (400kHz)

4. **Built-in Recording Level Check Oscillator for Air-check**

   Good quality tape recordings of FM programs depends on proper setting of the recording level of the Tape-deck. With the TX-8500II, this can now be accomplished simply and accurately by oscillator signal which is equivalent to 37.5kHz deviation.

5. **Improved Quality in AM Reception**

   With the incorporation of another recently developed IC (HA1197), distortion in the low frequency region has been reduced to less than 1/3 previous levels.

COMPARISON CHART PIONEER VS OTHERS

Brand Name Model No.	PIONEER TX-8500II	KENWOOD KT-7300	MARANTZ 112	SANSUI TU-5900
FM TUNER SECTION				
IHF Usable Sensitivity	10.3dBf (1.8μV)	10.3dBf (1.8μV)	9.8dBf (1.7μV)	10.3dBf (1.8μV)
50dB Quieting Sensitivity				
Mono	16.1dBf (3.5μV)	16.8dBf (3.8μV)	—	16.0dBf (3.5μV)
Stereo	37.2dBf (40.0μV)	38.3dBf (45.0μV)	—	38.0dBf (45.0μV)
S/N, Mono/Stereo (65dBf)	79/75dB	73/68dB	70/60dB	70/60dB
T.H.D. Wide/Narrow (1kHz)				
Mono	0.08/0.15%	0.1%	0.15%	0.25%
Stereo	0.1/0.4%	0.2%	0.3%	0.35%
Capture Ratio Wide/Narrow	0.8/2.0dB	1.0dB	1.6dB	2.0dB
Alternate Ch. Selectivity Wide/Narrow	35/80dB	80dB	60dB	60dB
Stereo Separation (1kHz) Wide/Narrow	45/45dB	45dB	42dB	40dB
Frequency Response	20Hz–15kHz$^{+0.2}_{-0.5}$dB	20Hz–15kHz$^{+0.2}_{-1.5}$dB	50Hz–15kHz±1.0dB	30Hz–15kHz$^{+1.0}_{-2.0}$dB
FEATURES				
V.C. Composition FM/AM	4/2	4/2	—	3/2
Meters	2	2	1	2
Output Level Control	Yes	Yes	No	Yes
Rec. Level Check	440Hz Tone Burst	No	No	No
IF Band Switch	Yes	No	No	No
Multipath	Multipath Output	Multipath Output	No	No
Muting Switch	1 step	1 step	1 step	1 step
Pilot Cancel Circuit	Yes (Auto Cancel)	No	No	No
AM Tuner	Yes	Yes	Yes	Yes

TX-8500II OTHER SPECIFICATIONS

FM SECTION

Image Response Ratio	85dB
IF Response Ratio	100dB
Sprious Response Ratio	90dB
AM Suppression Ratio	55dB
Subcarrier Product Ratio	72dB
SCA Rejection Ratio	62dB

AM SECTION

IHF Sensitivity	Ferrite Antenna	300μV/m
	External Antenna	15μV
S/N		50dB
Selectivity		30dB

OTHERS

Power Consumption	20W
Dimensions (Without Package)	420(W) x 150(H) x 395(D)mm
Weight (Without Package)	8.1kg

NEW TECHNOLOGY AND TECHNICAL TOPICS

IF BAND SELECTOR

1. The Need for an IF Band Selector

The 2 most important features of any tuner are the ability to accurately select the desired broadcasting station from among the numerous other radio signals, and to reproduce that signal with a high degree of fidelity. However, in order to reduce the amount of distortion in reproduced sound, it is necessary to widen the pass band in the IF stage. But this runs counter to the necessity to make the band narrower in order to eliminate unwanted interference signals. Hence, the IF band selector has been developed in order to satisfy both requirements. In areas with little interference, reception in the wide band will give sound of a very high quality. In areas with considerable interference, reception in the narrow band will ensure a high degree of selectivity and a clear, interference-free sound. Pioneer has adopted this system in both the TX-8500II and TX-9500II.

2. IF Band Selector in the TX-8500II

Fig. 1 is a block diagram of the FM IF amplifier in the TX-8500II. The band switching in this circuit is performed by switching diodes. When the IF BAND switch (S_1) is put in the WIDE position, the diodes D_3 and D_4 are biased in the forward direction, and consequently turn ON. The signal path goes via the ceramic filter (F_1) and the IF AMP (A_1), then through the 2 diodes (D_3 and D_4) and onto the IC (PA3001). When the switch (S_1) is in the NARROW position, however, the diodes D_1 and D_2 are biased in the forward direction, and thus turned ON. The signals consequently pass through 4 ceramic filters (F_1, F_2, F_3, and F_4) before reaching PA3001. The filters used in this system are 2-element ceramic filters which feature 35dB selectivity ratings, and long group delay times. As a result, total harmonic distortion in the WIDE position is 0.08% for mono, and 0.1% for stereo. In the NARROW position, using 4 of these ceramic filters, an alternate channel selectivity of about 80dB has been achieved, while distortion has been suppressed to 0.15% during mono, and 0.3% during stereo. The selectivity characteristics, and distortion level changes, for the WIDE and NARROW positions are shown in Figs. 2 & 3.

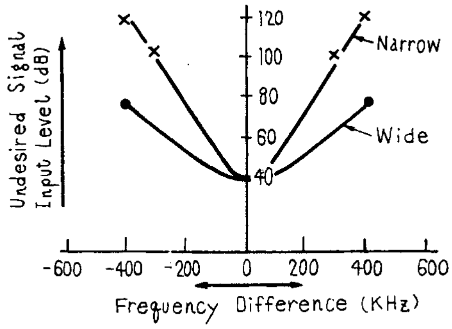


Fig. 2

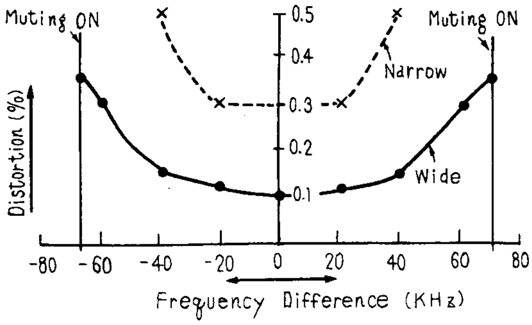


Fig. 3

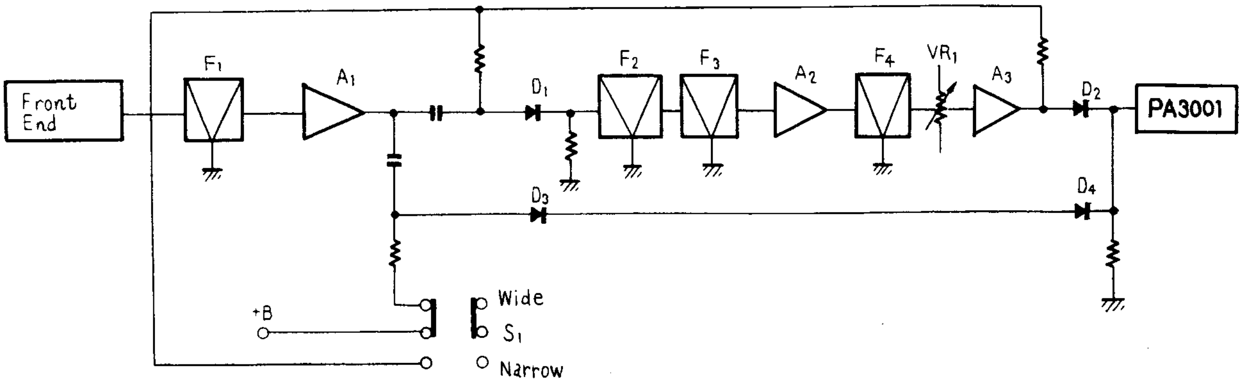


Fig. 1

RECENTLY DEVELOPED IC's

The 4 IC's employed in the TX-8500II and TX-9500II are all completely new IC's developed independently by Pioneer. Their high performance, diversified functions, and high reliability help satisfy the high demands made of top quality hi-fi tuners.

1. Use of the New IC's

PA3001	IF amplifier, detector, tuning meter, signal meter, and muting level control.
PA1001	NFB type PLL stereo demodulation, automatic pilot canceller circuit.
PA1002	low noise NFB operational amplifier, muting.
PA2002	constant voltage power supply, protector circuits.

2. Features of the PA3001

The PA3001 features less noise (than the previous HA1137), a new detector circuit (quadrature detector), and better S-N ratio.

The IF amplifier (see block diagram in Fig. 4) consists of the high-gain 3-stage differential IF amplifier plus diode limiter and quadrature limiter, in total 5-stage limiter, and serves to amplify the audio output following quadrature detection. Besides featuring better detector stage NF and detector efficiency than the previous HA1137, it also has a considerably reduced distortion (absolute value) and a better S-N ratio, due to greater flatness in its delay characteristics.

As a result, the TX-8500II features a distortion of 0.1% and an S-N ratio of 80dB during stereo. And in the control system, it is also now possible to adjust the muting level in accordance to the signal level.

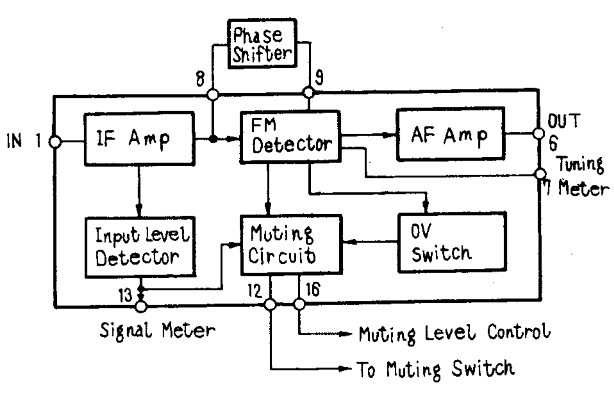

Phase Shifter
8
9
IN 1
IF Amp
FM Detector
AF Amp
OUT 6
Tuning 7 Meter
Input Level Detector
Muting Circuit
0V Switch
13
12
16
Signal Meter
Muting Level Control
To Muting Switch

Fig. 4

3. Features of the PA1001

The circuit composition of the PA1001, whose block diagram is shown in Fig. 5, is that of an NFB type PLL multiplex IC featuring an automatic pilot signal canceller. Although this feature has been described in further detail in the Technical manual for the TX-9500II, it is briefly, a circuit designed to cancel the 19kHz pilot signal automatically without any loss in the frequency characteristics of the demodulated signal. Previously, the pilot signal has been removed by the use of low pass filters with a dip point at 19kHz, but at the expense of some of the high end frequencies. The frequency characteristics, especially in the high frequency region, have consequently been greatly improved by this circuit. In the TX-8500II, this rating is +0.2dB, − 0.5dB at 15kHz. In addition, because of the adoption of the NFB type operational amplifier as the demodulated signal amplifier in this IC, further improvements have also been achieved in S-N ratio.

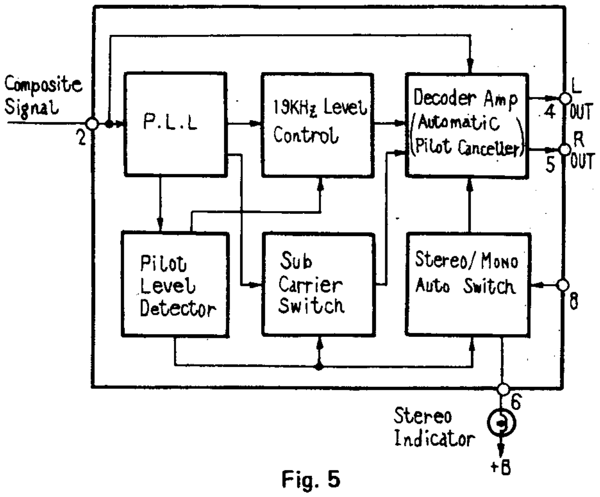

Composite Signal
2
P.L.L
19KHz Level Control
Decoder Amp (Automatic Pilot Canceller)
L 4 OUT
R 5 OUT
Pilot Level Detector
Sub Carrier Switch
Stereo/Mono Auto Switch
8
6
Stereo Indicator
+B

Fig. 5

4. Features of the PA1002

See Fig. 6 for the block diagram of this IC. Its circuit features a differential direct-coupled NFB type operational amplifier with extremely low distortion, and a dynamic range above 150kHz modulation. And processed for ultra low noise, this IC alone boasts an S-N ratio in excess of 90dB. The de-emphasis characteristics also make use of the NFB loop in the AF amplifier. Special attention has also been given to the selection of circuit elements which have influence on the frequency characteristics. Variation among such elements has been greatly reduced by the use of metal film resistors (1% tolerance) and carefully selected styrol capacitors. Furthermore, non-distorting electronic switches have also been used in muting circuits. These switches are activated immediately a trigger voltage appears at pin No. 8, or when a DC voltage is applied from the power supply ON/OFF muting circuit, thus short circuiting signal circuits electronically to ground with much less noise than in reed relays.

5. Features of the PA2002

See Fig. 7 for the block diagram of the PA2002. This IC, incorporating constant voltage circuits with protective circuits, features a ripple suppression factor of 80dB. The protection circuits include control circuits, some of which are activated by over-voltages, and others by over-currents. For example, extra large currents appearing at the output circuit of the IC due to overloads caused by short circuiting of the load, or when a voltage in excess of 27V appears at the input of the IC (pin No. 1).

As a result of the adoption of these outstanding IC's, all of which employ very recent technological advances, the distortion, S-N ratio, and frequency characteristics etc. in the TX-8500II certainly stand head and shoulders above those of other similar units.

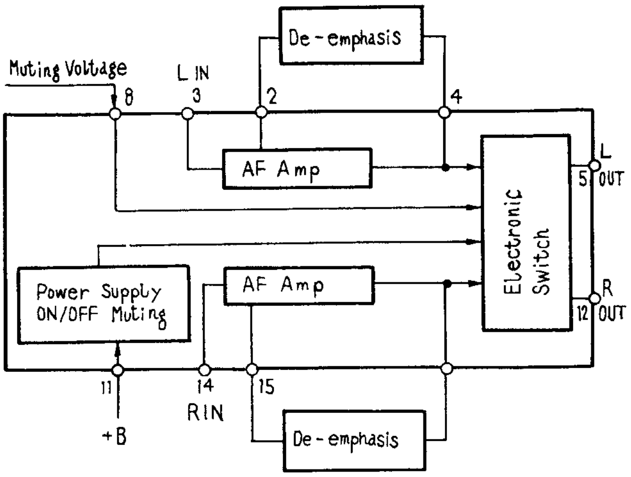

De - emphasis
Muting Voltage
L IN
8
3
2
4
AF Amp
Electronic Switch
L
5 OUT
Power Supply ON/OFF Muting
AF Amp
R
12 OUT
11
14
RIN
15
+B
De - emphasis

Fig. 6

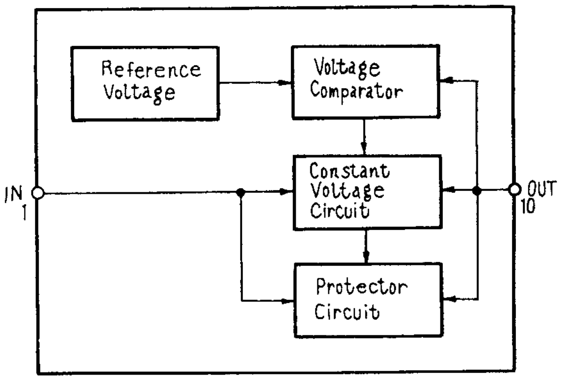

Reference Voltage
Voltage Comparator
IN
1
Constant Voltage Circuit
OUT
10
Protector Circuit

Fig. 7

BASIC TECHNOLOGY

THE FM FRONT-END

1. Role of the FM Front-End

The front-end consists of the 4 following sections (see Fig. 1):
(a) antenna input circuit, (b) radio frequency amplifier, (c) mixer circuit, and (d) local oscillator.

The function of the front-end is to select the desired radio signal, reject all other unwanted signals (including radio signals from adjacent stations), amplify the very weak radio signals, and convert them into intermediate frequencies by means of the local oscillator and mixer.

2. Antenna Input Circuit

The antenna input circuit is the tuner's "front door" where the impedance of the antenna is matched with the input circuit impedance, adjacent station interference is suppressed, and signals from the desired station only are received. This antenna input circuit is one of the more vital stages as far as designing is concerned because of the need for strong suppression of intermodulation and spurious interference, and the consequent effects on sensitivity and noise figure. Noise figure is determined by the amount of insertion loss of the antenna input circuit, and the quality of the amplification elements.

The insertion loss of the antenna input circuit is employed so as to cause deterioration in the noise figure. Insertion loss may be calculated by the following formula:

$$\rho_{\ell} = \left(1 - \frac{Q_L}{Q_o}\right)^2$$

where Q_o is unloaded Q
and Q_L is loaded Q

Since Q_o is determined by the coil and printed circuit board materials, insertion loss reductions have to be accomplished by reducing Q_L.

But any reduction in Q_L will lead to deterioration of the selectivity in the antenna input circuit, resulting in deterioration of image rejection intermodulation interference and spurious interference. In tuner designing, the problem is whether to give priority to improving interference suppression, or

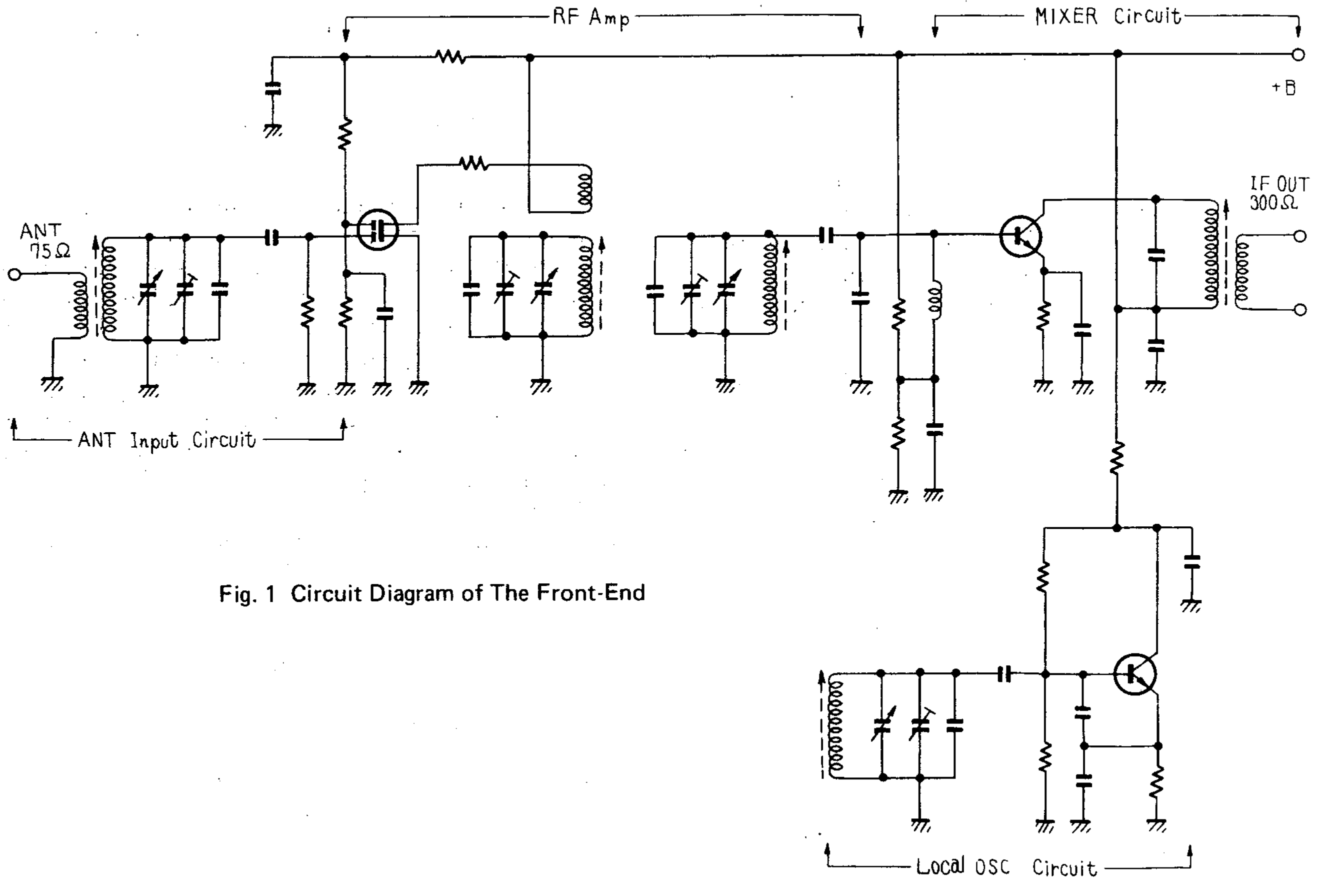


Fig. 1 Circuit Diagram of The Front-End

improvement of sensitivity (which will deteriorate if the noise figure deteriorates). And since tuners are hi-fi equipment, priority is given to suppression of interference.

3. Radio Frequency Amplifier Circuit

3.1 The role of the RF amplifier circuit is amplify the weak radio signals, suppress the noise generated within the front-end, and reject adjacent station interference. It then sends signals onto the mixer.

The amplifier elements in between the antenna input circuit and RF amplifier circuit also have to operate as perfect buffers. If a J-FET is used for this purpose, it is usually set to neutralization point, since the capacitance between drain and gate, that is, feedback capacitance, generates irregularities in oscillation etc.

Most ordinary tuners these days employ MOS-FET's. Because of the special features of the MOS-FET, described below, they are used in great numbers in the radio frequency circuits in TV sets as well.

(a) Since feedback capacitance is less than 1/10th of that in the J-FET, there is no need for neutralization.
(b) Small noise figure.
(c) Since mutual conductance is large, sufficient gain can be obtained.
(d) Also has much better squaring characteristics than the J-FET and other transistors, thus improving cross modulation and intermodulation characteristics.

Since the Q_L of the antenna input tuning circuit is usually set at a low value (because of the previously mentioned reasons), selectivity for rejection of adjacent channel interference is mainly determined by the selectivity of the tuning circuit in the RF amplifier.

3.2 The selectivity of the RF amplifier circuit may be by a number of different ways. Since double tuning circuits have better characteristics, and higher selectivity, than single tuning circuits, double tuning circuits are either combined with other double tuning circuits, or with single tuning circuits. The systems adopted by Pioneer are:

(a) Single tuning + single tuning (3-ganged VC)
(b) Single tuning + double tuning (4-ganged VC)
(c) Single tuning + double tuning + single tuning (5-ganged VC)
(d) Single tuning + double tuning + triple tuning (7-ganged VC)

The Front-end shown in Fig. 1 employs the 4-ganged VC circuit (b). The 5-ganged VC circuit (c) has been employed in the TX-9500II and SX-1250. With an image rejection ratio and spurious response of over 110dB, the use of multi-ganged variable capacitors with more than 5-gangs is not really necessary.

4. Mixer Circuit

The purpose of the mixer is to mix the signals received by the antenna and amplified by the RF amplifier, with frequencies generated by the local oscillator, and then select out only the intermediate frequency (10.7MHz). Where the frequencies of the antenna input signals are 87.4 to 109MHz, the local oscillator generates frequencies from 98.1 to 119.7MHz, so the difference between the received frequencies and the local oscillator frequencies will always be 10.7MHz.

If the received frequency is f_R, the local oscillator frequency f_o, and the intermediate frequency f_i, the task of the mixer, then, is to maintain the relation $f_o - f_R = f_i$. Or again, if the received frequency is represented by $\cos \omega_R t$, the local oscillator frequency by $\sin \omega_o t$, and the intermediate frequency by $\sin(\omega_o - \omega_R)t = \sin \omega_i t$, and the received frequency is multiplied by the local oscillation frequency thus:

$$\sin \omega t \times \cos \omega_R t$$

$$= \frac{1}{2}\sin(\omega_o + \omega_R)t - \frac{1}{2}\sin(\omega_o - \omega_R)t$$

$$= \frac{1}{2}\sin(\omega_o + \omega_R)t - \frac{1}{2}\sin \omega_i t$$

Component sums and differences of 2 signals are generated, the difference being used as the intermediate frequency. Since this is the simple multiplication of 2 frequencies, the mixer can be thought of as a multiplier used to produce the intermediate frequency. Where a dual gate MOS-FET has been used, the radio frequency signal is usually applied to gate 1, and the local oscillator frequency to gate 2. Mainly MOS-FET can be considered as a multiplier type of mixer.

Another method employs the non-linearity of the elements. Non-linearity can be considered according to the following formula:

$$i = A_o + A_1 e + A_2 e^2 + A_3 e^3 + \ldots\ldots$$

If the sum of the 2 previously described signals (where $e = \cos \omega_R t + \sin \omega_o t$), is applied to such non-linear elements,

$$\begin{aligned} i = A_o &+ A_1(\cos \omega_R t + \sin \omega_o t) \\ &+ A_2(\cos \omega_R t + \sin \omega_o t)^2 \\ &+ A_3(\cos \omega_R t + \sin \omega_o t)^3 + \ldots\ldots \end{aligned}$$

For brevity, only the $(\cos \omega_R t + \sin \omega_0 t)^2$ term will be considered, and this is expanded to

$$\cos^2 \omega_R t + 2(\cos\omega_R t \times \sin\omega_0 t) + \sin^2 \omega_0 t$$

Again, there is multiplied component of two signals, component sums and differences of 2 different frequencies are obtained, the difference component representing the intermediate frequency.

The mixer circuit shown in Fig. 1 includes a transistor to whose base both the radio frequency and local oscillator frequency have been applied. So it is apparent that the non-linearity characteristic of the transistor has been employed.

Fig. 2 shows an example of how the mixer circuit operates. If the frequency of the incoming signal is 98MHz, the frequency of the local oscillator will be 108.7MHz. The sum and difference components consequently generated are 206.7 and 10.7MHz. Only the 10.7MHz frequency is passed through the filter in this case.

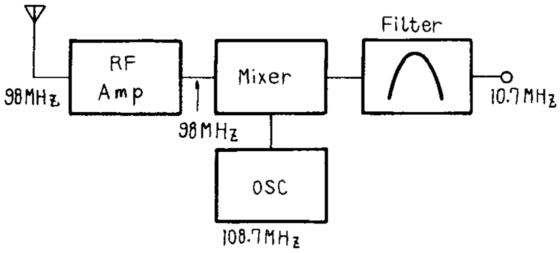


Fig. 2 Mixer Operation

5. Local Oscillator Circuit

Since the conversion of the radio frequencies into the intermediate frequency is impossible without the local oscillator, and because any drift caused by changes in temperature or humidity will have direct effect on the tuning scale position and other tuner features, this circuit is also known as the "heart" of the front-end.

6. Performance Ratings Determined by Quality of Front-End

The characteristics determined by the quality of the front-end are listed below:

(1) Spurious response (½ IF rejection ratio, 2nd oscillator ± IF rejection ratio)
(2) Image rejection ratio
(3) IF rejection ratio
(4) Sensitivity (IHF sensitivity)
(5) 50dB quieting sensitivity
(6) AM suppression ratio

Other characteristics required in the designing of the front-end include:

(7) Image rejection intermodulation interference
(8) Cross modulation interference
(9) Noise figure
(10) Power gain
(11) Blocking
(12) Frequency drift due to changes in temperature and humidity.